The Oxford Handbooks for Medical Auxiliaries

SURGERY

A GUIDE TO SURGICAL DIAGNOSIS
AND TREATMENT
INCLUDING TROPICAL SURGERY

by

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PREFACE

THIS book has been written primarily for the use of Medical and Hospital Assistants in the tropics. An endeavour has been made to present the basic facts of surgical pathology and the principles of surgical practice in as readable a form as possible.

Attention is called to the differences in the practice of surgery in the tropics and in temperate climates these are, however, few and it is hoped that this book may also be of interest to Medical Auxiliaries in Britain and that it may even be of some assistance as an introduction to surgery for medical students.

It is now eighteen years since my predecessor the late Mr W K. Connell, published his *Surgical Handbook for Hospital Assistants in the Tropics*

Since that time a radical change has taken place in surgical practice and there has also been a very marked rise in the standard of education of Medical Auxiliary students throughout the British Commonwealth and Empire.

Inflammation and its attendant complications no longer play as great a part as formerly, for with the sulphonamide drugs and the antibiotics it is now often possible to achieve resolution where an incision would have been judged inevitable On the other hand advances in surgery and especially in anaesthesia, have greatly widened the scope of surgery in other fields Cancer is seen more frequently partly owing to an increased expectation of life and partly because we are now treating in Africa a generation which has been brought up since infancy to appreciate the advantages of Western Medicine.

In view of all these changes it is felt that the time is now overdue for a completely new approach to the subject.

My thanks are due to Mrs Connell for the use of booklets prepared by her husband early in the last war and which were to have formed the basis of a new book.

I wish to record my gratitude also to those colleagues and others who have been of such great assistance in the preparation, revision and proof reading of this work.

W G K.

Dar es Salaam
July 1956

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PART ONE

GENERAL SURGERY

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INTRODUCTION

A DOCTOR or Medical Assistant, working by himself or in a small out patient department, has to treat every variety of disease and illness, but when a patient has to be admitted to hospital it is usual for him to be sent into either a medical or a surgical ward. Whoever sees the case first must therefore decide whether the case is *medical* or *surgical*

Twenty or thirty years ago this was fairly easy—all cases of injury were naturally surgical so were tropical ulcers requiring dressings, septic cases that would probably need incision to drain pus and any other kind of condition for which the best known treatment was operation. All other conditions were medical

Since that time there have been big advances in treatment, especially in the use of drugs such as penicillin which may make operation unnecessary in many cases You will find that quite a large number of cases in the surgical wards never go to the operating theatre and that *conservative* treatment plays quite a large part in their care. On the other hand, with big improvements in anaesthesia and the development of new approaches in operations, many diseases that used to be beyond surgical care are now referred to the surgeons for operation.

Lastly there are quite a number of diseases such as peptic ulcers and poliomyelitis where the patient will get the best treatment if he is seen by a combined team of physicians and surgeons

To summarize, then some cases are obviously surgical some, although customarily sent to the surgeon, could be treated equally well in either medical or surgical wards and some are best treated by team work between physicians and surgeons.

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PART ONE

GENERAL SURGERY

CHAPTER 1

INTRODUCTION

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Chief causes of disease

Pathology is the study of the causes of disease, and a good knowledge of pathology is as important as a good knowledge of anatomy and physiology so that treatment can be applied intelligently

There are six main groups of diseases and in this book we shall discuss them in general terms first and then, in the later parts of the book, see which of them are most important in different parts of the body The six main headings are

(1) *Injury*
(2) *Acute infection.*
(3) *Chronic infection*
 (i) Persistent acute infection.
 (ii) Infection which is chronic from the start.
(4) *Tumours*
(5) *Congenital abnormalities*
(6) *Degenerative endocrine and other diseases* This last heading is rather a mixture, but as most of the conditions arising from these causes are medical it is convenient to group them all together in a surgical book.

Before going into fuller detail it will be helpful at this stage to say just a few words about what we mean by these headings.

Injury needs no further definition at present.

Acute infection When we talk about acute surgical infection we mean invasion of the body by bacteria. In some cases the bacteria act quickly and either kill the patient or stimulate a quick response from him—that is acute infection Sometimes, however the body is not able to get rid of the infection in spite of a quick response This happens most often if the bacteria are protected from the body's blood-supply by being surrounded by dead tissue or by scar tissue. The infection then persists and we have *the first kind of chronic infection*

Infection which is chronic from the start This is caused by another group of organisms or bacteria which invade the body slowly cause a slow response from the patient, and if they are going to kill him, usually do so slowly There are not many of these diseases, but they are important The most common are tuberculosis leprosy syphilis yaws filariasis and amoebiasis. You will notice that not one of these is a purely surgical condition. It is only certain of the complications of these diseases

that interest the surgeon and you will hear much more about them from the physicians and the venereologists.

Tumours A tumour is a lump But when we are talking about tumours in medicine we mean a special kind of lump What we mean is an *abnormal growth* of tissue and we divide the tumours into two kinds, benign and malignant. We shall discuss this in greater detail in Chapter 11 but, in the meantime we can say that benign tumours are made of normal looking cells and that they remain local, while malignant tumours are made of abnormal looking cells which can invade other tissues and spread by the blood and lymph streams to other parts of the body They are called malignant because they will cause the death of the patient if they are not treated before this spread occurs.

Congenital abnormalities These are conditions that a child is born with, such as extra fingers or toes, and they are not very important as a rule. Sometimes they are hereditary that is they are passed down from one generation to the next, while sometimes there is no apparent reason for them. One small group affects the heart these arise from the fact that the foetus in the uterus has a different blood-circulation from the adult, and sometimes this difference persists Surgical treatment for many of these heart conditions can now be carried out, but it is very difficult and can only be done in special centres. It will not be necessary to write a separate chapter on the congenital abnormalities, but the more common ones will be mentioned in their proper place in our discussion of regional surgery

Degenerative, endocrine and other diseases These, like injuries, need no further discussion at present.

CHAPTER 2

WOUNDS AND INJURIES OF SOFT TISSUES—SKIN SUBCUTANEOUS TISSUE AND MUSCLE

INJURIES are caused by sharp or blunt objects and in the latter case, the skin may or may not be penetrated If the object is really sharp then almost the only damage received by the patient will be a cutting or division of the tissues injured but if the object is not very sharp there will also be some bruising while, if the object is very blunt, then bruising will be the most prominent lesion. (A lesion is a pathological change in tissue as the result of disease or injury)

A blunt object may cause the skin to split if the force behind it is strong enough—just as the skin of an orange may split if it is thrown on the ground with sufficient force. This is how the skin of the scalp may be broken when it is struck with a stick With less force the skin and inner tissue would only be bruised.

The extent of bruising following an injury is most important, especially if the skin is also broken. In a bruise, small blood vessels are torn, with the result that bleeding occurs within the tissues This blood is trapped, because it cannot find a way out of the wound and an effusion of blood of this kind is called a *haematoma*

In more extensive wounds, the muscles tendons and other structures in them may be destroyed by the force of the blow or they may die because the small blood vessels supplying them have been damaged. It must be remembered that there is no food more suitable for the growth and multiplication of bacteria than dead tissue or a haematoma Think of the rapid infection which occurs in a piece of meat which is almost pure muscle if it is left exposed to the air for one or two days especially if it is allowed to remain moist.

If the skin is broken infection can enter any wound either from the dirty weapon that caused the wound or from the patient's skin or clothing or later from the air to which the wound has been exposed

Even in a 'closed' injury infection may develop in the haematoma by bacteria being carried to the spot in the blood stream, from some other area in the skin or throat that is septic. This does not happen frequently, but when it does occur, the infection is known as a *blood-borne infection*

If the infection is mild or if no infection has occurred at all (as we all hope will be the case in every 'clean operation) then the body can proceed with the task of repair

In cuts of the skin and subcutaneous tissue most of the divided vessels are very small and, within a short time, the bleeding ceases owing to clotting of the blood. The first bleeding is very useful as it will help to wash bacteria out of the wound. When the bleeding has stopped, the clot will prevent further infection from getting in, so long as the wound is kept dry and is not disturbed. If the wound is gaping wide it can, of course, be made smaller by stitching the edges together but it is not always necessary to do this nor is it always wise, as we shall see later

In the course of a few days the clot shrinks and is then invaded by small new blood vessels from the sides of the wound. New fibrous tissue is laid down round the blood vessels and the wound is thus healed in its deeper part. The vascular young fibrous tissue formed during repair is known as *granulation tissue* The other tissues, such as fat and the deep layers of the skin, also try to grow across the gap but they are not as successful as the blood vessels and fibroblasts and they usually fail to meet before they are permanently separated by the scar tissue.

On the other hand the epithelium, which is the top layer of the skin, has special powers, and it will not stop growing until it meets epithelium from the other side. This is a very important fact, as we shall see in the treatment of ulcers and burns and other conditions for the method of repair is similar whether tissue has been destroyed by injury or infection.

Finally then, a clean wound is healed by a covering of epithelium lying over a scar But one more event takes place over the next few weeks, and that is that all scars of fibrous tissue shrink. In an extensive wound this may cause deformity but in a very small cut it will not be noticed.

Complications There are three important complications of wounds apart from scar deformity The first is an over active repair by the fibrous tissue and epithelium resulting in the formation of a *keloid* The second and much more important, is

infection of the wound Infection causes many troubles, but the most important to consider at this stage is the fact that it will cause a delay in the healing, especially of epithelium. The third, and also very important complication of injury, is *shock* (see Chapter 3)

Treatment of a clean wound

In a clean wound the important principles of treatment are

(1) Control of bleeding if necessary

(2) Examination for other injuries for example of nerve, tendon, major blood vessel, bone or internal organ and also injuries in other parts of the body

(3) Stitching of the wound if the gap is large and if it is quite safe to do so Only the skin should be stitched it is unwise to stitch muscle.

(4) If the wound is small the clot should not be disturbed.

(5) The application of a dressing to keep the wound dry Unless there is evidence of infection the dressing should be left undisturbed until the wound has healed

(6) Prescription of such rest as is necessary

The last two points require a little further explanation. Moisture will break down a clot and let infection into a wound, and the wound can become moist either from frequent dressing or from sweat. Adhesive strapping is a bad dressing for wounds unless many holes are cut in the strapping or the gauze of the dressing is allowed to project beyond both sides of the strapping If the wound is completely sealed by adhesive strapping then sweat collects and the wound can become infected from the bacteria from the moist skin. A wet antiseptic dressing such as acriflavine can be applied at the time of dressing as this will soon become dry The dry dressing will then stick to the wound. It should then be left stuck to the wound until healing is complete.

Healing is much quicker where there is a rich blood-supply for example on the face or scalp and stitches there should be removed in three to four days. Healing elsewhere is much slower but seven days are usually sufficient. Tendons have a very poor blood supply and, as we shall see later we do not expect them to heal in less than three weeks.

Rest is very important for healing but is often abused and

care must be taken, for example that a person with a small wound on one finger does not spend too long with the whole hand at rest in a sling

INFECTED WOUNDS

Infected wounds should *not* be stitched unless they have been converted into clean wounds by a surgical operation.

Any wound that has not been caused by a really sharp instrument contains bruised and possibly dead tissue. We have already seen that this tissue is easily infected. Also any wound, whether made by a sharp or a blunt instrument, is bound to become infected if it has not been sealed by clot or stitches within six hours. By this time bacteria are not only lying on the surface of the wound where they could be wiped off by an antiseptic, but have grown into the walls of the wound.

Therefore two reasons for *not* stitching a wound are

(1) If the stitching would shut in bruised or dead tissue.

(2) If the wound occurred more than six hours previously

Even in the case of clean wounds stitching should not be carried out if this pulls the skin edges very tightly together or if there is a risk that later swelling may make the tension too great.

Injury and infection both result in tissue swelling and the more severe the bruising or infection the greater will the swelling be. Not only are small vessels torn, making a haematoma, but serum passes out of bruised and dilated blood-vessels thus increasing the swelling This swelling known as *oedema*, may take some hours to develop and, in a stitched wound, may cause sufficient tension to cut off the blood supply from the skin edges which will then die.

Primary *suture* or stitching should only be carried out in clean sharp-cut wounds which are less than six hours old and in which the skin edges can be brought together easily

Treatment of infected wounds

Any wound containing bruised tissue or one that is more than six hours old is probably infected Treatment in this case is as follows

(1) If the wound looks clean, but is more than six hours old and less than twelve hours old it is quite safe to cut away (excise) all the walls of the wound and then stitch it—as long

as the third rule is remembered and the wound is not stitched tightly When we say excise the walls of the wound we mean excise a narrow strip of skin (which has a good blood supply) and make a much bigger excision of all deeper tissues, making sure that no bruised or dead tissue is left behind. Care must be taken during this excision to avoid injury to intact nerves or large blood vessels If there is still a chance of infection developing the wound must not be stitched If the chance is very slight then it is probably safe to stitch the wound, but it is then wise to give added protection by prescribing one of the sulphonamide drugs or penicillin.

(2) If the wound is obviously infected or if it looks clean but has been left unstitched for more than twelve hours then treatment is again different. Now it is unsafe even to excise the walls of the wound in case infection is allowed to spread through the body s defence barrier into deeper tissues It is in this type of case that tetanus is most likely to develop and a preventive injection of antitoxin should be given (see p 86)

In these cases all loose and obviously dead tissue is removed *and the wound is left open* It is then treated with antiseptic dressings until it becomes clean. When this occurs it may be safe to excise the walls and perform a *secondary suture*

Despite the rules given above for not stitching infected wounds it may be necessary to stitch the skin in an infected wound to close the abdomen or the chest.

(3) The last point to be considered is the stitched wound which becomes septic in spite of all care. One must always be on the look out for this This does not mean that the dressing must be taken off frequently to have a look *at* the wound. That is against our rule of leaving the wound undisturbed as long as possible. The removal of a dressing too soon will either tear out the clot or will have to be done by soaking the wound and thus making it moist.

What must be done is to watch for other symptoms and signs of inflammation such as throbbing pain or a raised temperature Then once infection is suspected, the dressing is removed if there are any signs of infection the degree of infection must be assessed If it seems to be mild, the wound is re-dressed and sulphonamides or penicillin are given If it is moderate or severe the stitches must be removed and treatment given as for a severely infected wound. *This is dealt with further in Chapters 8 and 9*

CHAPTER 3

INJURIES OF SOFT TISSUES—TENDONS, NERVES AND BLOOD-VESSELS

TENDONS

TENDONS are the strong bands of tissue joining muscles to bones. They pass across the surface of joints and, when the muscle contracts the pull of the tendon causes the joint to move They have a relatively poor blood supply It is important to remember that, if they become infected the body will find difficulty in overcoming the infection. Like the skin the blood-supply will be reduced further if the tendons are stitched with tension

Injuries to tendons are most often caused by a cut with a sharp weapon, or when tendons are torn and crushed in a wound with extensive laceration and bruising of the skin. In the first case, the tendons of the wrist and fingers are the most frequently damaged. Such cases frequently follow fights The tendons may be cut by an actual blow Sometimes, however, the victim, in trying to defend himself by catching hold of his attacker's knife, may cause it to cut through the skin and tendons of his fingers. In a crushed wound there will be considerable bruising of the soft tissues when a foot is badly torn in a motor accident, for example, such injuries round the foot and ankle are common.

If any part of the body is hurt where there are important tendons which may have been damaged the patient must be carefully examined for signs of loss of function. We should think what a tendon in that part of the body should be able to do and then see if the patient can perform it. He may complain that the pain is too severe for him to try any movement, but it is important to test function and the patient must be persuaded to make at least one effort to do so

Treatment

The poor blood-supply of tendons must be remembered. They should only be stitched together if the wound is absolutely

clean and is less than six hours old. If the tendons are stitched under any other circumstances there is a grave chance that they may become infected and then die The patient is then very much the worse off because of treatment—not only is his tendon divided, but some of it is dead and it may never be possible for the ends to be rejoined. Dead soft tissue is called a *slough* and infection will persist in the presence of a slough until either the body has thrown it out or the slough has been removed surgically

If there is any doubt about the cleanliness of the wound all bruised and dead tissue should be excised and then the wound should be left open or as we have seen closed by stitches in the skin only After all infection has disappeared, a fresh incision can be made usually in about three weeks, for *secondary repair of the tendon.* It must not be done, however until good healthy skin covers the tendon.

There is one other injury to tendons that should be mentioned here, although it is not strictly a wound. Sometimes a tendon becomes old and frayed (degenerative disease) and may break or rupture if a sudden strain is put on it. This may happen in three important parts of the body—one is the Achilles tendon the second is the patellar tendon and the third is a little tendon in the shoulder called the supraspinatus which is responsible for the first few degrees of abduction of the arm. (*Ab*duction of a limb is the act of drawing it *away* from the mid line of the body This word may be compared with *ad*duction, which means drawing the limb *towards* the mid line)

In these cases, *there is no risk* of infection and treatment is not urgent the tendon is repaired on the next convenient operating day

NERVES

We are considering here the peripheral nerves not the central nervous system. The latter is rarely injured without injury occurring also to the spine or skull Injuries to that system will be considered when we discuss those parts of the body

When considering wounds of peripheral nerves a good knowledge of their anatomy is essential—we need to know not only the name of any nerve which might be injured at the site of the wound, but also the exact functions of that nerve

You will remember that nerves have both a sensory and a motor function. Some nerves contain mostly motor fibres

(e.g the radial), some contain mostly sensory fibres The majority (e.g the median and ulnar) are mixed nerves (i e they contain both motor and sensory fibres)

Nerves like tendons, are most often damaged in open wounds, but some nerves are particularly liable to be damaged in closed injuries, the chief example of the latter is the radial nerve, which may be damaged when the humerus is fractured. Nerves may also be damaged if a deep injection is given in their neighbourhood

It is usually taught in First Aid that one of the principal signs of a fracture of a bone is 'loss of function but that is not only the sign of a fracture, for loss of function can also be caused by pain by division of tendons and by division of nerves In fact unless you can see the divided tendon or nerve in a wound, loss of function will be the only proof that damage to a tendon or a nerve has occurred. A tendon is a white cord a nerve is not quite so white. If you look at the divided end of a nerve, you will see projecting from it little bundles of the fibres of which it is composed.

A nerve has a better blood-supply than a tendon but it is very liable to severe damage if infection occurs. Infection of a wound anywhere in the body is repaired by scar tissue, and scar tissue is always greater in amount after infection than when it follows uninfected wounds. In a severed nerve, scar tissue may prevent the nerve fibres from growing again across the gap between one cut end of the nerve and the other

Treatment of a severed nerve is the same as of tendons Nerves should not be sutured together except in a very recent, absolutely clean wound. They should be left for secondary suture, and, when the surgeon stitches them, he must be careful to put his stitches through the outer sheath only

The nerves are among the most wonderful structures in the body It will be remembered that each nerve is composed of a large number of nerve axons each of which arises from a cell in the central nervous system, that motor cells transmit messages to muscles and that sensory cells receive messages from muscles, skin, etc. along these axons. In the sciatic nerve for example, the axons, although microscopic in diameter may be over three feet long stretching from the cells in the region of the lumbar spine to the tip of the big toe.

When a nerve is cut across, or badly bruised, these axons

are divided, but the cell itself is not killed. After some ti
recovery the axons start to grow again, and if the pati
lucky, they will grow down their old sheaths, and reach
own motor or sensory end plates in muscle or skin. Un
nately, after complete division and suture this does not a
happen some *sensory axons will grow down to motor*
plates and some motor axons will grow down to sensory
plates. That is why results from suture of mixed nerv
never so good as they are from suture of mainly motor or n
sensory nerves.

When the axon starts to grow down the distal part of the
again, it does so very slowly, at the rate of about one
quarter inches a month for re-growth and the return of fun
If the distance is short, and the repair has been made soo
axon of a motor nerve will find a healthy muscle waiting :
But the longer the journey, the less likely is that to b
Unless it has a nerve attached to it, a muscle slowly atro
and is replaced by fibrous tissue.

Therefore, a nerve that is known to be divided shou
sutured as soon as it is safe to do so without the chance of st
up old infection in the wound. The best time of all is :
three weeks after the injury when the axons have recovered
injury and begun to grow again Even then the result cann
expected to be good if the nerve axons have a long way to t
or if the nerve is a mixed nerve, and results will be poorer :
presence of infection has made further delay necessary

The biggest difficulty of all arises in a closed' nerve in
Loss of function shows that the nerve has been damaged, b
is not possible to tell whether it has been torn across or
bruised as it cannot be seen. If the nerve is only slightly bru
function will return within two or three weeks If it is b
bruised the axons may have been broken but not the n
sheath the axons will then easily grow again down their
paths In this case function will return in almost as n
months as the number of inches the injury is distant from
muscle In such cases of doubt, the surgeon has to do or
two things If he thinks that, probably only bruising is pre
he will wait for the appropriate number of months and per
a month more. If no function has returned by then he will
sume that the nerve was actually divided and he will ope
examine the nerve and repair it if necessary

If however, he has any doubt, or if he thinks that the distance would be too great to risk waiting, he will advise an early operation in order to examine the nerve and see how badly damaged it is. This will be illustrated best by two examples

(1) There is a closed fracture of the humerus and paralysis of the radial nerve. The fracture is two inches above the elbow, and the radial nerve supplies muscles one inch below the elbow It would be quite safe to wait three to four months for nerve recovery, but if there is no sign of recovery after four months an operation should be performed so that the damage can be inspected if then it is found that the nerve was actually divided it can be sutured and a good recovery can be expected in another three to four months—that is seven to eight months after injury

(2) There has been a dislocation of the hip, and paralysis of the sciatic nerve twenty inches above the knee. The nerves enter the calf muscles about two inches below the knee. It would be very wrong to wait thirty months (two and a half years) before exploring the site of injury to see whether function will return to the calf muscles and then to wait another another two and a half years for function to return! By that time the muscles would be of no use at all even if they got back their nerve-supply

Fortunately paralysis in closed injuries is not common and even more fortunately the nerve most usually injured in this way is the radial in conjunction with a fractured humerus. As the radial nerve is almost purely motor, results are usually very good indeed and a few months delay does not matter very much.

BLOOD VESSELS

Blood vessels vary very greatly in size. Haemorrhage is only likely to be dangerous either if very large vessels are divided or if many medium and small vessels are cut or torn for example, those in the muscles of the thigh in a severe fracture of the femur

Some blood vessels even though they are only capillaries are bound to be damaged in any injury severe enough to cause a patient to be brought to hospital. If the skin is broken, the result is a *haemorrhage*. If the skin is intact, the blood cannot escape and the result is a *haematoma*. Blood trapped inside the skin soon loses its oxygen content and becomes dark then, as it is absorbed by the body it slowly changes colour to purple and green. These colour changes can easily be seen when white

skin is bruised. The discoloration may take six or more days to disappear If a very large haematoma is present this may contain liquid blood, which will not clot so long as it remains in the body

Treatment

This will vary with the severity of the haemorrhage. Very mild capillary bleeding will stop in a few minutes, except in some very rare blood diseases *but it will stop only if it is allowed to do so* that is if the blood is allowed to clot. The blood will not clot if it is constantly washed or sucked away, or if the pressure of blood in the wound is maintained by hanging the limb down or by applying a tourniquet badly A lightly applied tourniquet is very dangerous and is used too often. Although the tourniquet is not tight enough to stop the flow of arterial blood into a limb, it will probably be tight enough to prevent venous blood from flowing out of the limb back into the body This will greatly increase the congestion of the veins, and raise the pressure in the capillaries to such an extent that bleeding is increased instead of stopped.

A tourniquet cannot of course be applied in cases of bleeding from the head neck, thorax or abdomen, nor for internal haemorrhage, *and it is very very rarely necessary for limb haemorrhage*

First Aid control of bleeding should be carried out by

(1) Putting the injured part at rest, if necessary making the patient lie down

(2) In the case of a limb injury elevating the limb

(3) Applying a pad and a *firm* bandage.

These three measures will stop all bleeding except the severest. If the bleeding is really severe it may be controlled temporarily by compressing the artery at a known pressure-point between the wound and the heart or by the application of a tourniquet, until the pad and bandage have been applied to the wound itself If blood comes through the bandage, it is probable that the bandage was not applied tightly enough It is wrong in this case to add more wool and another bandage on top of the first. The first bandage must be taken off and reapplied properly This also applies to haemorrhage after operations

Almost the only occasion when *a tourniquet will have to be* applied and left on until the patient gets to hospital is in the case

of a really severe compound fracture with injury to the femoral or brachial artery In this case the limb may be so badly lacerated that bandaging with pressure, to control bleeding will be out of the question. If so, it is possible that the limb may have to be amputated on arrival at hospital.

On the face and scalp, the capillary blood supply is very rich, so that even small cuts are accompanied by quite a brisk haemorrhage. Blood pours down over the face and clothes, and the patient looks much more hurt than he really is Fortunately the capillary haemorrhage will stop rapidly with pressure and the rich blood-supply of the face also leads to rapid healing Such clean wounds, even if large enough to be stitched, heal in three or four days

On arrival in hospital any tourniquet that has been applied *must* be removed at once and only reapplied if bleeding starts again. The dressing will then be taken off and inspected. This can be done in the out patient department, but if it is known that the injury is severe it is better not to disturb it before the patient is in the operating theatre. With the bandage still in position it is almost always possible to test for function and see whether tendons or nerves have been divided or bones broken

When the wound is inspected it should be treated in the way already given. That is, if the wound is under six hours old and contains no dead tissue, it can be stitched straight away If it contains dead muscle, or if it is more than six hours old, the walls of the wound must be excised before stitching If it cannot be fully excised, if it appears inflamed or certainly if it is more than twelve hours old it must be left unstitched and treated as an infected wound. It should not be forgotten that a bigger skin incision may have to be made to excise hidden dead tissue, just as an incision has to be made in order to operate on any other part of the body

During wound excision, bleeding will have to be controlled. Once the skin has been fully divided in an operation, its edges draw away from each other and the divided blood vessels contract. This encourages the blood to clot. In a few seconds all bleeding from capillaries ceases so that the bleeding only comes from small subcutaneous bleeding points which are slightly bigger vessels. These will at once be caught in artery forceps If the vessels are relatively small the crushing by the artery forceps will damage the inner walls sufficiently for our purpose the blood will clot and bleeding will not start again when the

forceps are removed, unless the clot is torn off by wiping the wound with a swab That is why the surgeon and his assistant are trained to dab wounds gently and not to wipe them.

If the vessels are a little bigger, it is wiser to ensure they will not bleed again by tying them off with a ligature of catgut or silk.

As the excision of the wound goes deeper, any foreign bodies are removed and all dead subcutaneous tissue, muscle or tendon is excised. The best way of making sure that all the dead tissue has been removed is to go on cutting bits away until you come to a piece of tissue that bleeds and is therefore alive. For this reason excision of wounds should not be done with a tourniquet on. Sometimes a tourniquet should be applied before the operation starts so that the dressing can be safely removed and the skin cleaned. The wound can then be opened and the biggest vessels caught and ligatured then the tourniquet can be released and the rest of the excision carried out in the normal way

During excision we try to remove as many foreign bodies as possible, including dead tissue so we must not put others in unless we have no alternative. That is to say, we ligature as few vessels as we must in order to stop haemorrhage. Muscles are not stitched together as any suture material would be a foreign body The muscles will be joined together by scar tissue during healing

Blood-vessels do not branch in the way that one is led to believe from the pictures in text books. Some of the branches go downwards, while others turn back and go upwards to join those that are coming down from above. This joining is called an *anastomosis* It explains why when a small artery is divided, it bleeds from both ends and therefore why both ends have to be caught in forceps and possibly ligatured It also accounts for the fact that it is quite safe, as a rule, to ligature larger blood vessels The part of the body which might be cut off from its blood supply will receive oxygenated blood from branches returning from below

If however the *main* blood vessel of a limb is divided the anastomoses may not be sufficient to provide enough oxygen to the limb below If the blood-supply is totally inadequate all the tissues will die thus giving rise to *gangrene* making necessary the amputation of the limb If the blood-supply is cut off slowly as in some diseases the limb will dry and shrivel—*this is*

known as *dry gangrene*, but if the blood supply is cut off suddenly the tissues remain moist and can easily be infected—this is known as *wet gangrene* The word *gangrene* may be used if all tissues in a limb or part of a limb have died, but the word is particularly used to refer to the death of skin

Occasionally there is sufficient blood supply by anastomoses to prevent gangrene of skin, but the muscles which need a very rich blood supply to keep them alive, die and are replaced by fibrous tissue. This tissue contracts, pulling on the tendons and giving rise to deformities—a condition known as *ischaemic contracture* We shall see that sometimes this is a particular danger to be guarded against in the treatment of fractures

A good blood-supply past a break in the main blood supply is known as a good *collateral circulation*

Internal haemorrhages will be dealt with later, but we must say here that internal haemorrhage is often severe It resembles bleeding into muscles in a very severe limb injury, and the first treatment necessary may be that for the prevention or treatment of shock.

CHAPTER 4

SHOCK

SURGICAL shock is an abnormal state of the body which results from injury There are two main types of shock and in the past these have been called 'primary and secondary' This was due to ignorance of their true nature They are really two totally different conditions and it is not correct to say that one of the causes of secondary shock is neglect of primary shock. There are still doubts surrounding some of the details of these two conditions with the result that various alternative names have been suggested none of which is completely satisfactory For this reason we shall continue to use the names 'primary and secondary remembering that the one is *not* secondary to the other

PRIMARY SHOCK

Primary shock is a *neurogenic* condition that is, it is a result of stimulation of the nervous system. It probably occurs to a slight degree in every injury and it is always very much worse if it is *associated with fear Because of this stimulation of the central* nervous system by fear and pain, there is a sudden dilatation of the blood vessels in the intestines and in other parts of the body This dilatation rapidly expands the area into which the heart must pump blood. As the heart cannot possibly send blood everywhere at once, there is bound to be some reduction in blood supply to the head and brain for these lie above the level of the heart and therefore have to be reached against the force of gravity This causes faintness and sweating, and a slightly lowered blood pressure. Also the pulse is slowed down by stimulus of the vagus nerve, which goes to the heart.

The condition is not serious and very soon the sympathetic nervous system responds The small arteries, or arterioles in the gut contract again the blood pressure is restored the brain again receives an adequate blood supply and the patient recovers.

The symptoms and signs of primary shock are a feeling of faintness possibly with actual loss of consciousness, a slow

feeble pulse, and sweating The symptoms may be apparent immediately after the injury, or the patient may be able to keep himself going by will power or by the excitement of the accident or by being busy in helping others But when he relaxes and thinks of his own injuries, *delayed* primary shock may develop

Treatment

Treatment for primary shock is

(1) Laying the patient down flat and then providing warmth and reassurance, the latter is particularly important. Patients who are ignorant of the effects of injury can be very frightened and the onset of primary shock will frighten them even more this, in turn, will tend to make the shock worse. If the patient is made warm and comfortable and possibly given a sedative and a little time is spent assuring him either that there is nothing seriously wrong or that he is in good hands and will be looked after he will very soon recover

(2) Most first aid books advise that a drink of hot, sweet tea should also be given if available. It should be remembered, however that the patient may need an operation in a few hours, and that nothing may be given by mouth if there is any chance that the patient will require a general anaesthetic. Small sips of water to moisten the mouth may do little harm, but tea containing milk will have to be digested shock upsets the digestive system and thus when the patient has his anaesthetic, he may vomit, and some of the vomit may be sucked into his lungs with serious consequences. If the patient smokes, a cigarette will be very soothing and much less harmful than tea.

SECONDARY SHOCK

Secondary shock is caused by a reduction in the amount of blood available for circulation.

In the first stage of secondary shock there may be all the symptoms of primary shock for a short time, but this state is rapidly corrected and the blood-pressure and pulse are restored to normal.

Unless the actual loss of body fluid has been very small the arterioles will have to remain contracted to maintain the blood-pressure, and the patient becomes restless alert and anxious until

the circulating blood volume has been restored. *If the fluid is not* replaced promptly the arterioles may relax and then the later stages of secondary shock develop

Fully developed secondary shock is a different matter altogether In this state blood is lost from the circulation for a longer period and the body has greater difficulty in correcting the loss Owing to the lowered circulating blood-volume, secondary shock is now frequently called oligaemic shock. If the loss of blood is small, the body may be able to correct it by itself, but if it is moderately severe then active medical treatment will be required. If the loss is very severe, or if medical treatment is not given, the patient will reach the stage when no amount of medical treatment will be able to rectify the shock or cure the patient. This condition is known as *irreversible shock.*

The *circulating blood-volume* may be seriously reduced in the following ways

(1) By severe external or internal haemorrhage.

(2) By loss of large quantities of plasma in severe second or third-degree burns. (See Chapter 5)

(3) By severe leakage of blood into bruised muscle in an injury where *crushing has occurred.*

(4) As in primary shock, pain and fear will cause dilatation of the arterioles in the intestines and elsewhere, and this will make the patient s condition worse still.

Pathology

First Stage When the circulating blood volume is reduced, the body tries to restore the full circulating volume as quickly as it can. We have seen, in the discussion on primary shock, that this is done by the sympathetic nervous system, *which stimulates* contraction of the arterioles and so tries to reduce the area in which the blood has to circulate.

Second Stage If fluid continues to be lost from the circulation then the sympathetic nervous system is no longer able to deal with the situation. The blood pressure begins to fall and the heart can only get the blood to the important centres in the brain by increasing its rate. So the signs of the second stage are a rising pulse-rate and a falling blood pressure however the sympathetic nervous system is still working blood still gets to the brain in adequate quantity and the patient remains alert and

anxious Meanwhile the blood-supply to the limbs is being steadily reduced and they feel very cold and dry

We can see that it would now be very bad treatment to warm the limbs simply because they felt cold. In such a case it is part of the body's defence to keep the limbs short of blood If they are warmed, the blood vessels will dilate and the blood will be drawn away from the brain, kidneys and other important centres Although the limbs are cold on examination the patient himself does not usually notice this. If this is so the limbs must *not* be warmed. Warmth should only be applied if the patient's whole body feels cold, and then the danger of *over* heating must be avoided.

Third Stage In the next stage of shock the circulation begins to fail. The blood pressure falls more and more rapidly and the pulse becomes rapid and feeble. Owing to the poor circulation, the blood does not become properly oxygenated in the lungs and becomes darker the walls of the blood-vessels are not properly nourished. This leads to weakening of the walls of the blood vessels and plasma is able to escape into the tissues

If we refer again to the causes of secondary shock we will see that one of them is loss of plasma. If plasma is being lost into the tissues owing to a lack of oxygen for the blood-vessel walls the shock will naturally become more severe and if this loss of plasma is not treated, the blood vessels and the brain will in time become so badly damaged that treatment will be of no use.

Before this stage is reached the patient shows clear signs of shock he is no longer alert, he is breathing heavily in order to try to obtain more oxygen and his limbs are cold and clammy Treatment, if it is to be effective, must be prompt prevention is better than cure.

Another thing to remember is that reduction of circulating blood volume may be rapid, as in cases of injury to the liver spleen or the large blood-vessels of the limbs or it may be slow as in extensive burns. As a rule, however symptoms and signs develop more rapidly in neurogenic shock than in oligaemic shock. That is why it was once thought that the former was primary and the latter was secondary and that secondary shock might be prevented by the proper treatment of primary shock.

The course of events in severe secondary shock may be summarized as follows

Loss of circulating volume is followed by a falling blood-

pressure. This is followed by poor oxygenation of blood and damage to the blood vessels. The damaged blood vessels allow plasma to escape, thus causing a further reduction of the circulating volume. The whole condition will be hastened if pain and fear cause dilatation in the intestinal vessels, so that quantities of blood are trapped there and can no longer circulate

Treatment

If shock is very mild the body will soon respond through the sympathetic nervous system and by absorbing extra fluid into the blood vessels from outside the vascular system. The blood pressure will then remain normal. If however, it is known that there has been a large loss of fluid, precautions must be taken quickly to prevent the patient s condition from becoming worse The course of events explained in the last few paragraphs should be remembered and each contributing cause must be treated.

First of all, prompt action must be taken to *prevent further loss* of blood or plasma by (i) the use of pressure dressings, (ii) the application of artery forceps or ligatures and even (iii) the temporary use of a tourniquet. After that the foot of the bed is raised on blocks to improve the circulation in the head, and the patient is turned on his side to prevent difficulty in breathing, and so improve the oxygenation of the blood.

Next, the *pain and fear* must be relieved by the injection of morphine. The normal adult dose is one-quarter grain, but in a big healthy adult in severe pain, this may be increased to one-half grain Injecting morphine subcutaneously into the limb of a shocked patient is of no use. We have seen that the limbs are cold and that the circulation has been reduced by the body to protect itself Subcutaneous injection may actually be dangerous if one-quarter grain, given subcutaneously has no effect then three or four more injections may be thoughtlessly given during the next few hours, with the result that when the blood pressure has been restored by other treatment, the returning blood circulation may find one or more grains of morphine waiting If these get carried to the brain, they will cause disastrous results. In shock, therefore, morphine must be given intravenously so that the proper dose will enter the circulation at once.

Most important of all in the treatment of shock, *the circulating*

blood-volume must be restored The only satisfactory way to do this is by means of an intravenous drip' It is usual to talk about setting up a drip', but if the patient is seriously ill the fluid should not just be allowed to drip into the circulation, but should be allowed to run in as fast as it will go It is more correct, but unusual, to talk of setting up an intravenous infusion. (See Chapter 38)

Another important point is to decide what kind of fluid to use in the infusion. Saline or glucose-saline is quite useless No sooner is it put in the veins than it begins to pass out of the circulation again, either into the tissues or by excretion in the form of urine.

If blood has been lost, the correct treatment is replacement with blood and there is no really satisfactory substitute for this Unfortunately blood transfusions are not always possible blood may not be available, ready in a bottle there may be some delay in finding people willing to give a pint each, up to the three to six pints that may be needed and, lastly even if blood can be obtained, it may be of the wrong group When the blood available is different from that which is required, this is known as *incompatibility*

If haemorrhage is not desperately severe, or if the main fluid loss is of plasma, then life can be saved by the infusion of plasma from other people. This can only be obtained where there are many blood donors. Blood is taken from them regularly and is stored for use in blood-transfusion but blood will only keep fresh even in a refrigerator for three weeks Blood which is not used until after that period has its red and white cells removed and the remaining plasma dried and bottled It will then keep for years. Unfortunately, it is unlikely that sufficient donors can be found for a sufficient store of plasma to be preserved for use anywhere in the world.

However recent chemical research has been very helpful in discovering methods of manufacturing plasma substitutes These are chemical substances the molecules of which are so big that they cannot pass out of the blood stream. The molecules when dissolved in saline are so similar to plasma that many lives have been saved by such substitutes That known as dextran is, in my experience, the best of them in production so far

Following haemorrhage the early stages of secondary shock are fairly easily noticed, but we shall see in the next chapter that

shock in the case of burns is very slow to develop This gives an excellent opportunity for preventive treatment. If the burn is severe it is almost certain that in a few hours shock will develop If plasma or dextran is given beforehand, the shock may be entirely prevented

There is one last and very important point to be remembered that is, shock will be made worse by any sudden movement of a patient or by rough handling At the scene of an accident, the shocked patient must be lifted gently on to a stretcher and he must be carried to hospital very gently indeed Ambulance-drivers must be taught that more lives are likely to be lost than saved by exceeding the speed limit. When the patient is in bed, he must be turned gently and his clothes should only be removed if they are soaking wet, no surgery or anaesthetic should be considered until shock has disappeared. If shock has occurred in the operating theatre, the patient should be kept in the theatre until he has recovered sufficiently to stand the journey back to the ward and, when he gets there, he must be put back to bed very gently

Treatment Summary

Primary Shock Rest, warmth, sedatives, perhaps a small amount of fluid by mouth, or a cigarette.

Secondary Shock Stop fluid loss give intravenous morphine and replace lost fluid with blood, plasma or a plasma substitute. Follow progress with an hourly or half hourly record of the pulse and blood pressure. Handle the patient carefully and do not operate until shock has disappeared

BLOOD TRANSFUSION

The transfusion of blood is the only satisfactory method of restoring blood loss and in some cases it may be the only method of saving life Plasma or plasma substitutes may restore the blood pressure but they cannot increase the number of red blood-cells, which are essential for the transport of oxygen

When blood is transfused from one person to another every precaution possible must be taken to ensure that the patient (the recipient) does not develop a severe reaction because of incompatibility

If a serious operation is planned some days ahead, and it is known that blood will probably be required for the operation, there will be plenty of time for thorough laboratory tests to be made, in order to make sure that a donor's blood is compatible, but in a case of emergency, a rapid test is required This test may not give a perfect result, but the risk of a transfusion reaction will be very small, and it is a risk worth taking if it is a matter of life and death.

There are four main blood-groups and everybody is in one group or another The groups are named A B AB and O People whose blood group is O can give blood to patients in all other groups, which means that any patient can receive blood from someone else in his own group or from a group O donor There are, however quite a number of minor variations within the groups and even if donor and patient are in the same group a direct match of their bloods should be made.

The rapid method of direct matching referred to above is as follows

(1) A few c.c. s of the patient's blood is taken from a vein and placed in a centrifuge tube. Rapid centrifuging will drive the red cells to the bottom of the tube and leave only the patient's serum on the top

(2) A few drops of the donor's blood are collected by means of a needle prick or from the small test bottle attached to a bottle stored in the refrigerator The drops of blood are diluted with a little normal saline.

(3) A large drop of the patient's serum is place on a glass slide by means of a platinum loop and some of the donor's diluted red cells are added.

(4) After fifteen minutes the slide is inspected by placing it over a sheet of white paper If the donor's cells are compatible the mixture will have remained a uniform brown colour If the cells are incompatible, the serum of the patient will have caused the cells of the donor to clump together in groups.

The same clumping or agglutination, would occur within the patient if a bottle of incompatible blood was administered to him. He would then develop a rigor his temperature would rise, and possibly blockage of the kidneys would result, causing anuria. Blood for transfusion is always citrated to prevent clotting but this will not prevent agglutination.

Both malaria and syphilis may be transferred from one person

to another by a transfusion, but this is a risk worth taking if the transfusion is going to save life. The patient should be given anti malarial drugs after the transfusion, and part of the donor's blood should be kept for a Kahn or a Wassermann test. These tests are tests for syphilis and if they are found to be positive, the patient can receive early treatment with high doses of penicillin.

Blood no longer contains infection for either disease if it has been stored for more than five days, and this is one of the advantages of collecting blood at regular intervals and compiling a blood bank. It is of course, preferable to test all blood that is put into a blood bank and discard those bottles which are Kahn positive. The other chief advantage of a blood bank is that blood of all groups is always available for an emergency

CHAPTER 5

BURNS

Pathology

BURNS are injuries to the body caused by heat. The heat may come from a fire, or from the sun, or from an electric discharge (including lightning) or from very hot liquids (in which case the burn is called a *scald*)

The extent of a burn is estimated by the size and depth of the burnt or scalded area. The hotter the object that causes the burn, the deeper the burn will penetrate into the body The depth will also be affected by the length of time that the body is exposed to the heat. For example, if an epileptic patient falls into the fire while he is unconscious, his foot may be burned right through to the bone before he is able to wake up and draw the foot away while a burn of similar extent might be caused in a much shorter time by an extremely hot furnace.

When we are considering the *depth* of a burn, we can divide all burns into three degrees of severity

(1) In first degree burns there is a very superficial burning of the skin surface, and none of the skin is destroyed. Burns of this type may be noticed after excessive exposure of white skins to sunshine, when the skin becomes bright red, tender and a little oedematous.

(2) In second-degree burns there is a partial destruction of the skin. The superficial layers are raised in blisters whose outer walls are made of dead epithelium. A mild second-degree burn will only affect the superficial layers of epithelium, and recovery is rapid if infection is prevented. In a deep second-degree burn, the only epithelium left is at the bottom of the hair follicles and sweat glands. But the epithelium is there, and, if it is not destroyed by infection, it can grow out across the burned surface to meet epithelium that has been undamaged, and complete recovery will follow

(3) In third-degree burns the full thickness of the skin has been destroyed and there is no epithelium left at all. Repair can only take place by the growth of scar tissue, and the slow creeping

of epithelium over the burnt surface from its edges In an extensive burn this is a very slow process, and if epithelium is not replaced by skin grafting, then a large amount of scar tissue will be formed, causing many deformities as it contracts Burns caused by electricity are almost always third-degree burns and there is always an area around them which is more damaged than appears at first inspection. Because of this, they are very slow to heal. In a really severe third degree burn there may also be burning or charring' of muscle, nerves, tendon, blood vessels and even of bone.

It is usual for third-degree burns to be accompanied or surrounded by areas of second-degree burn and these in their turn will be surrounded by a zone of first-degree burn.

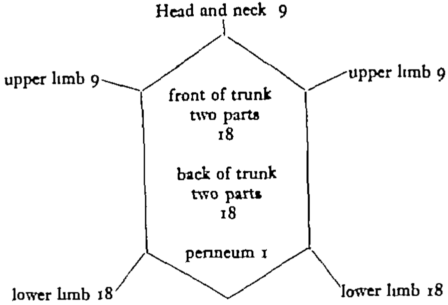
The depth of a burn is important, so that an estimate can be made of the tissues that have been destroyed, and of the chance of healing without the formation of scar tissue.

All burns are accompanied by a loss of fluid. Some of it leaves the body *as in the blisters of second-degree burns*, and some of it leaks into the damaged tissues in the form of oedema. In the second case the fluid is still in the body but it is lost to the circulation. This loss continues for several hours after the burn has occurred, which is why the shock of burns is often delayed and can be prevented Fluid loss, and therefore shock, is most severe in second-degree burns, because in third degree burns, the surface of the skin is so thoroughly killed that it becomes hard and dry and so cannot exude fluid outside, nor swell with oedema inside.

It must also be remembered that in third degree burns and *extensive deep, second-degree burns there may be an actual* destruction of red blood-cells. If so anaemia will develop that may be severe enough to require blood transfusion Most of the fluid lost, however is plasma and so it is plasma or a plasma substitute that must be given to prevent or treat shock. In a very mild burn simple saline given intravenously or even fluids by mouth may be sufficient to overcome thirst. Naturally the more extensive the burn the greater will be the fluid loss and the greater the amount of fluid that must be given to replace it. And so an estimate of the extent of a burn is as important as an estimate of its depth

A very good estimate of the *extent* of a burn can be made by following the Rule of Nines by which the body is divided up

into eleven parts each of which consists of approximately 9 per cent. of the body surface.



An example can now be given of the history and examination of a burned patient

Admitted at 10 a.m. having been burned by boiling water at work four hours ago Burns of face, upper limbs and chest amounting to about 18 per cent. of the body surface (face 3 right upper limb 6 left upper limb 2 chest 7) One small area on chest probably third-degree, remaining 16 per cent. second-degree.'

You will notice that it is not always possible to be certain at once whether part of a burn is deep second-degree or actually third degree.

Causes of death

If a burn is severe enough to cause death this may occur at various times after the injury, according to the pathological cause which has led to death

Death may be immediate owing to the severity of the burn or to the effect of electricity or lightning Lightning behaves in a most peculiar way Someone killed by lightning may be burned very severely or a person may be found dead or unconscious with not a sign of a burn on his body but possibly lying naked, because

his clothes have been stripped off and thrown yards away by the force of the electric shock! Prevention of sudden death from burns depends on care in the use of hot things so that accidents may be avoided. This applies especially in the home, for it is there that most patients are burned, especially children.

If a burn is not immediately fatal, but is very extensive, death may occur within the next twenty four to forty-eight hours through shock. This can be prevented if treatment is given early enough and with sufficient care, before the shock becomes irreversible

Death from shock is now extremely rare in well-equipped hospitals, but deaths still do occur and usually happen during the second or third week after injury These deaths are mainly due to the infection of a very extensive burn, which may still occur despite every effort made to prevent it. However, there may be yet other undiscovered causes.

Signs and symptoms

First-degree burns are rare among Africans, but they may occur following exposure for a short time to intense heat. The skin is a little swollen and tender and if the colour can be seen it is red owing to dilatation of the skin capillaries It is treated by the application of soothing lotions, such as calamine, and the giving of mild sedatives such as aspirin together with fluid by mouth to relieve thirst. Very occasionally in a European, a very bad first-degree burn may be accompanied by sufficient loss of fluid from sweating to cause secondary shock that will require intravenous infusion for treatment. As very little plasma has been lost this can be given as saline. The condition is known as heat stroke and it can occur from simple loss of fluid by sweating without any sunburn.

In mild second degree burns, there may be very few signs at first, but, in the course of a few hours, blisters gradually appear If these are small and soft they can be treated as first degree burns in the out patient department, and a dry dressing can be applied to prevent injury to them. In deeper second degree burns, the blisters appear more rapidly and the epithelium may be stripped off over quite a large area. The skin underneath is exposed and tender and pain is severe The exposed skin may be pink, in which case we know that it is alive or it may be white

and bloodless It is in these last cases that we cannot tell whether there will be total skin loss, or whether there are still some islands of live epithelium deep down in the hair follicles and sweat glands Doubtful cases should be treated like second-degree burns for a week to ten days, after which it will become obvious which course they are going to take.

In third-degree burns the skin is completely dead. Pain is much less than in second-degree burns, as the nerve-endings in the skin have been killed This can be tested by pricking the surface of the skin with a sterile pin. The skin may be white, or it may be so badly burned that it has been charred black. In the latter case it is probable that deeper tissues have been burned as well If it is known that the skin is dead, it is also known that eventually it will all come away and the exposed area must be treated by skin-grafting If the area is small, it is sometimes possible to excise the whole burn at once under an anaesthetic in the same manner as a wound and either stitch the edges together or cover them with a skin-graft straight away

Treatment

The treatment of first-degree, small mild second degree, and small third degree burns has already been mentioned in the previous three paragraphs.

The most important points to remember are that pain should be relieved by appropriate sedatives, thirst should be relieved by giving the patient water or sweet drinks, and any exposed area should be covered with a dry sterile dressing This dressing must be kept dry and should be left undisturbed for seven to ten days.

The really important burns are the extensive second and third-degree ones which we will now consider All second-degree burns which involve more than 10 per cent. of the body surface and all third degree burns require admission to hospital.

First Aid. Different surgeons have preferences for different types of dressing, and later treatment may be spoilt or made more difficult by the application of oil or tannic acid jelly or other things by the first aid worker All that should be done is to give sedatives, cover the burn with a clean cloth to prevent further infection and get the patient to hospital or to a doctor as soon as possible.

cetavlon gently, but carefully and thoroughly If the patient has shown some distress during the cleaning the remaining parts must be left until he has recovered again and, if necessary the dose or half the dose of morphine should be repeated. If the patient shows signs of severe shock, no cleaning will be possible at all, and the dressing must be applied straight away to the exposed burn and dead epithelium.

Whatever dressing is used, it should, if possible be antiseptic, it should exclude the air, and it should not delay healing

The following are the most popular dressings

Flavine in water, 1/1,000 This is applied on lint or gauze which is then wrung out nearly dry, and is applied to the wound and covered with one layer of dry lint or gauze and a bandage. This dressing is antiseptic and, as the flavine evaporates the plasma exuding from the burn begins to clot and the dressing becomes dry Bacteria cannot penetrate a dry wound. Tannic acid used to be used by itself or with acriflavine to form a hard dry scab, but it has been found that it can be absorbed by the body and then damage the liver

If the dried flavine dressing is taken off while it is still sticking to the burn it will tear off the new epithelium which is trying to grow This is avoided by leaving the dressing on for seven to ten days. If sepsis occurs, the affected part of the dressing becomes loose It can be cut away, and a dressing of eusol or 20 per cent. saline applied The firm dry dressing does not cause stiffness to the fingers if applied to the hand stiff finger joints if infection is absent, are due to the heat of the burn which has damaged the ligaments of the joints.

Soft paraffin gauze The advantages of soft paraffin gauze is that it does not stick to the burn The disadvantages are that it keeps the burn moist, because perspiration is unable to escape unless only one layer of very wide mesh gauze is used, and so bacteria may be able to flourish In addition it is not antiseptic. It may be combined with powdered penicillin dusted over the wound under the dressing but sulphonamide powder should not be used for an extensive burn as it is easily absorbed and may damage the kidneys If sulphonamide powder is applied, not more than ten grams, equal to twenty tablets, should be used. The maximum dose should not be repeated more often than five times during the course of treatment. This method is not recommended

Many other methods have been devised and some of these are very successful. Two methods used during the war were (i) continuous soaking of the burn in saline baths, and (ii) the use of a great deal of wool and a firm pressure bandage. These methods are rarely used now.

Since the war, very good results have been obtained by the exposure treatment. In this method the burn is left exposed to the air, and the plasma leaking on to the surface is allowed to form a dry, sterile crust, while the lost plasma is replaced by intravenous fluids. For the best results the whole area must be sprayed with penicillin powder: this spraying must be repeated every few hours until a good crust has formed and then the spraying needs to be repeated if ever the crust becomes broken. If this is not done, there is a grave danger that a large septic area will develop. The method is not very suitable for hot, moist, tropical conditions and there is also the risk that the penicillin may actually delay healing or allow resistant strains of bacteria to develop.

Infected burns. If, despite care, burns become infected they must be treated as septic wounds (see p. 65). The sepsis may destroy the epithelium by ulceration, and in these cases the epithelium will have to be replaced by skin-grafting as soon as the affected area is clean. The best dressing for any wound is skin.

Third-degree burns. In third-degree burns the whole thickness of the skin has been lost and must be replaced. The dead skin, however, is firmly attached to the subcutaneous tissue and must first be removed. If it is left for too long, sepsis is bound to occur and the dead skin will slowly slough off, but this takes a long time. Meanwhile the patient is suffering from chronic sepsis and there is a dense layer of scar tissue forming under the slough.

Whenever possible, dead skin should be excised as soon as the patient can stand the operation and in any case within twelve days of burning. The exposed area is grafted either at once or during a second operation when clean red granulations of new capillaries have covered the wound. In an extensive burn several visits to the operating theatre may be required, and one burnt part is dealt with during each visit. Meanwhile, the patient must be kept well nourished, sepsis kept low and anaemia corrected by the giving of iron and by blood transfusion.

CHAPTER 6

POISONOUS BITES AND STINGS

ANIMAL BITES

THE mouth of any animal, including that of man, is always full of organisms, and wounds caused by animal bites contain bruised, lacerated and infected tissue. They should always be left open and treated as infected wounds, unless they are seen within a very few hours of injury and very carefully excised.

SNAKE BITE

Snake bite is more serious than the bite of other animals because of the risk of the injection of venom by the snake into the tissues Not all snakes are poisonous but it is as well to treat all snake bites as if they were! The actual bite of a snake is a very small puncture, and very few bacteria get into the wound but the poison soon causes local swelling which may spread rapidly up the limb and, *if the poison gets into the blood-stream* it can cause death by its effect on the heart and other vital centres.

The most common bite in East Africa is from the night adder which causes very mild symptoms. The venom of the puff adder is very much stronger and causes severe local swelling The swelling may be severe enough to reduce the blood supply to the limb so that gangrene of a whole or of part of the limb may develop Fortunately this is rare, but it will naturally be made more likely if a tourniquet has been applied tightly and left on for too long The poisons work very fast and danger from death by poisoning usually ceases in less than an hour In fact, if a patient lives long enough to reach hospital it is unlikely that the bite will kill him. There are very few general symptoms, apart from fear after adder bites

Cobra and mamba bites are fortunately rare they may give rise to severe or fatal heart failure. A spitting cobra may cause severe conjunctivitis by spitting venom into the eye.

When *treatment* is applied in hospital it will differ from first aid treatment.

In first aid, the intention is to try to prevent death from poisoning A tourniquet should be applied rapidly above the bite. This should be tight enough to stop the blood returning by the veins, but it need not be tight enough to stop blood from going into the limbs by the arteries The tourniquet should be removed completely in thirty to forty minutes. If anti-venom serum is available it should be injected at once, two ampoules of 10 c.c. are required for most bites but this should be increased to four if the snake was known to be a cobra One of the ampoules should be injected under the bite A cut should be made over the bite to let blood wash out the local poison and the wound should be washed out with a strong solution of potassium permanganate. Crystals of permanganate must not be rubbed into the wound, as they will damage tissue.

In hospital there is very little further danger of death from poisoning except in the rare cobra or mamba bites and attention is directed mainly to the swollen limb and to the relief of pain. If the patient feels faint the cause is either poisoning or primary shock. There has been little loss of fluid and so secondary shock is not present. If the patient has arrived within half an hour of the bite first aid treatment will be required, but if the delay is greater the only general treatment required is rest in bed, lowering the head, the injection of morphine and, possibly a cardiac stimulant such as coramine Any tourniquet which is on must be removed. Four ampoules of anti venom should be given intravenously in the case of profound collapse from cobra or mamba bites and smaller doses may have to be repeated. No anti venom will be required for adder bites if more than an hour has elapsed since the injury

The limb soon looks so swollen and hot that the presence of infection is suggested. We have seen that bacterial contamination is slight, and so it is not necessary to give penicillin or sul phonamide drugs nor is it necessary to inflict further wounds on the patient by incising the bite and rubbing in potassium permanganate. The limb requires cool, soothing dressings of which the best is cold water which should be changed frequently and the limb should be elevated to reduce the swelling The swelling is largely caused by the release of a body chemical called histamine, and a lot of the swelling may be prevented if some of the new antihistamine drugs are given early It has also been suggested that 10 c.c. of 10 per cent. calcium gluconate r-

pain and assists recovery The dose should be given intravenously and repeated every eight hours

If the bite takes place on the neck, swelling may be severe enough to cause obstruction to breathing, and then an urgent tracheotomy will be required. A tracheotomy is an operation to make an artificial opening in the trachea below the larynx, and a metal breathing tube is slipped into the hole.

Conjunctivitis from venom from a 'spitting' cobra is treated by washing out the eye with milk and then putting in two drops of 10 per cent cocaine in castor oil

RABIES

Rabies is a virus infection which usually results from the bite of a rabid dog or jackal. In some parts of the world it may also be caused by blood sucking bats Rabies only exists in certain districts but it can be carried by dogs from infected to uninfected areas Regulations are often made to try to prevent this spread, and any dog that comes out of a rabies area into an uninfected area must be placed in quarantine in a kennel for six months This does not, however prevent spread by wild animals. Dogs may also be protected from developing the disease by injecting them with a rabies vaccine, but a vaccine has not yet been made which will guarantee perfect immunity

If any human being is bitten by a dog in a rabies area, immediate precautions must be taken. If the bite is on the head or neck, then the patient must immediately be given a course of injections of vaccine. These are quite painful and have to be given subcutaneously in a different part of the body each day for fourteen days. In order to be able to get a large number of different sites the skin of the abdomen is usually chosen.

The wound itself is treated in the same manner as any other bite but if the patient is seen within three hours the wound should be thoroughly swabbed with pure carbolic acid which may kill the virus

If the bite is on any other part of the body than the head or neck and the dog has not been caught, then a course of injections should also be given but if the dog has been caught it is safe to delay the injections while the dog is kept under observation for ten days. There are two reasons for this the first is that the further the bite is from the brain the slower the development of

of the disease, the other is that a dog is not infectious until just a few days before it shows signs of rabies itself If the dog shows no sign of rabies within ten days of biting someone then that person is quite safe. The dog should not be destroyed as soon as it has bitten someone, for a post mortem may not prove whether it was developing rabies it is much better to keep the dog under observation

Signs and symptoms

A dog or a man suffering from rabies develops marked fear This is later followed by spasms of the body, swallowing becomes difficult until even the swallowing of saliva becomes impossible The patient dribbles from the mouth and refuses to drink even water This last sign has given rise to the other name of rabies i.e. hydrophobia (fear of water) The saliva contains a large quantity of the virus and it is this which makes an infected dog s bite so dangerous.

During the stage of fear the dog may show signs of madness and will then be liable to attack and bite people. In some cases paralysis appears rather than convulsions and this is particularly common in dogs. This symptom in a dog is very dangerous indeed, as the dog does not appear to be mad but only ill and tired and it may be handled and carefully looked after by its owner until it dies, during this period infected saliva may get into a cut or abrasion when the dog affectionately licks its master

Treatment

There is no known cure once the disease has developed but vaccine given soon enough may either prevent the disease or make it milder so that the patient has a chance of recovering The vaccine acts by stimulating the patient to make antibodies to destroy the virus, but the body takes about two weeks to make enough antibody Serum full of antibodies can now be obtained and this should be injected at the same time as the vaccine. The serum will protect the patient during the time that he is making his own antibodies In severe cases all that can be done is to provide rectal or intravenous fluids and sedatives In fatal cases the patient dies of dehydration and exhaustion

POISONOUS STINGS

These are caused by hornets, bees and some poisonous fishes. They usually give rise only to mild local symptoms, but some fish stings and the stings from many bees may be fatal. Even the sting from one insect may be fatal if the patient has been made exceptionally sensitive to the poison because of previous stings.

Stings are treated by the application of soothing lotions such as calamine lotion; the sting itself should be removed as quickly as possible if it has been left in the body, as the body may continue to absorb poison from it. If there is a severe local or general reaction, then antihistamine drugs should be given for two or three days.

CHAPTER 7

INJURIES TO BONES AND JOINTS

Compound injuries

If there is an open injury to the skin and the other soft tissues over an injured bone or joint the injury becomes *compound* Because of the risk of infection of the bone or joint a compound injury is always more serious than a simple one. The principles of treatment are, however, straightforward.

Haemorrhage and shock must have first attention then the soft tissue wound is treated in the same manner as any other soft-tissue injury avoiding, of course, any unnecessary movement of the broken bone or joint. The skin is stitched if possible, but the wound will be left open if there is any risk of infection or if there is insufficient skin for the wound to be closed easily If the skin can be closed the injured bone or joint can then be treated as if it was a *simple* injury

If the wound has to be left open it is best to pack it with soft paraffin gauze and put the limb at rest in plaster of Paris After we have dealt with *simple* fractures we will come back to the subsequent treatment of a wound that has been left unstitched.

Closed injuries of bone

A bone which lies close to the skin may be bruised badly without an actual fracture occurring A haematoma forms under the periosteum and there is swelling pain and local tenderness but no other sign of a fracture. An X-ray will show at once if the bone has been broken, but X-rays are expensive and they are not always available in up-country stations. If there is no deformity and no abnormal movement at the site of injury, the best treatment is simply to apply a splint and rest the part.

If the limb is a lower limb it is advisable to admit the patient to hospital and elevate the foot of the bed, but in the case of an upper limb it may be possible to send the patient home. If pain and tenderness have almost gone in two or three days it is

almost certain that only a bruise has been present, and the patient can be encouraged to use the limb

If there is the smallest break in the bone a *fracture* is present When the skin is intact, these are known as simple fractures but the term 'closed fracture is very much better as the fracture may vary from a simple sub-periosteal crack to a grossly comminuted or displaced fracture, or one that is complicated by injuries to vessels, nerves or internal organs.

Signs and symptoms

The signs and symptoms of a fracture are

(1) Pain at the site of the fracture.

(2) Tenderness which is greatest just over the fracture

(3) Swelling which appears after a few hours

A knowledge of the most common fracture sites together with the presence at one of these of severe pain and severe local tenderness are the best guides to the occurrence of a fracture these two signs are always present. The next three may or may not be present

(4) Deformity or displacement

(5) Loss of function.

(6) Crepitus This is the grating sound felt and heard when bone ends rub together It is always accompanied by pain and one should try to avoid causing crepitus but if it is felt during examination or first aid treatment it will help to confirm the diagnosis

Types of fracture

Fractures may be divided into many types and in each case we want to know the answer to a number of questions before treatment can be started.

(1) The fracture may be simple or compound

(2) It may be accompanied by injuries to other parts of the body

(3) There may be deformity by angulation

(4) There may be deformity by rotation

(5) There may be deformity by lateral displacement.

(6) There may be deformity by upward displacement (shortening)

(7) The fracture may be transverse oblique or spiral

(8) It may be comminuted or non-comminuted

(9) Finally it may be complicated by injury to surrounding vessels or nerves or to underlying brain spinal cord or pelvic contents.

This is a formidable list, but all the points are important and, as we deal with fractures in different parts of the body we shall soon learn to look out for some, rather than others, at different sites. For example, the tibia is so close to the skin that fractures are often compound the radial nerve is so close to the humerus that it is sometimes bruised or torn across in fractures of that bone and the muscles of the thigh are so strong that all forms of deformity are common in fractures of the femur

Pathology of fractures and their repair

In order to understand fully the aims of treatment and the means of preventing later complications, we must study the normal process of repair of broken bone and see where that process can go wrong

It is unnecessary to go into further detail on the difference between simple and compound fractures or whether the injury has been caused by direct or indirect violence.

Whatever the cause of the fracture the result may be

(1) A small crack which does not extend right across the bone.

(2) A young bone may be bent like a green stick and snap on one side only this is often known as a *green stick* fracture.

(3) The bone may be broken cleanly across in a transverse, oblique or spiral direction.

(4) The bone may be broken into a number of small pieces at the site of the fracture.

In the last case which is called a *comminuted* fracture the small fragments may still be attached to the periosteum, or they may be torn free and therefore lose their blood-supply In a closed fracture this does not matter as no infection is present and they can be joined on to the rest of the bone again in the process of repair We shall see later that this will take rather a long time owing to the loss of blood supply to the loose portion. If however there are any completely loose comminuted fragments in a *compound* facture they should be removed all compound fractures are liable to become infected and it is a rule that all dead tissue must be removed from an open wound.

Repair after a fracture in its early stages, is very similar to repair of any other tissue The gap between the bone-ends is filled with blood-clot, and this is followed by an invasion with new young capillaries and the laying down of connective tissue. In other sites the connective tissue becomes replaced by fibrous tissue but in fractures the osteoblasts *or bone-forming cells* on either side of the fracture grow into the connective tissue and lay down new bone tissue. Most of this growth takes place from the soft inner bone and from the outside under the periosteum In this way a soft 'callus or swelling, is formed, it is soft at first, but in the course of a few more weeks calcium salts are laid down and the callus becomes hard. At this stage the fracture may feel quite firm and it is *clinically* united, but an X-ray may still show weakness in the union and the fracture will have to be protected from strain for a few weeks longer Finally, over the course of one or two years, the bone at the union is remodelled, the excess callus is absorbed, the bone cells are rearranged in a normal manner and from an X ray picture *it may be impossible to tell whether a fracture has ever* taken place.

X rays are extremely useful in giving information about the state of the fracture at all stages and if they are available it is most interesting to watch the progress after a fracture. It should be remembered, however, that they are not always available that they are expensive, and that on many occasions they are unnecessary, as proper clinical examination gives the doctor all the information he requires. For example, in a Colles fracture of the wrist, deformity will be obvious, the diagnosis is easy, and it is much more important to take an X ray to check that reduction has been properly done than to take an X ray *before* reduction.

Similarly after a fracture of the humerus, the presence of slight movement at the fracture site after four weeks shows that it is not yet united. An X ray is unnecessary and it is quicker and cheaper to apply a fresh plaster for two more weeks than to have another X ray taken. On the other hand, for example in injuries near the elbow hip or other joints, clinical diagnosis may be very difficult and then a preliminary X ray can be of very great help

It is not necessary to correct deformity in order to get bony *union, unless the deformity has separated the bone-ends widely*

or allowed muscle or other soft tissue to come between the bone-ends. If the bone-ends are close together and the bones are kept at rest, union is very likely The chief reason for correcting deformity is to enable the united bone to be as normal in shape and function as possible that is that mal union should be prevented. It is not necessary to get absolutely normal shape back to the bones as long as function is restored, but our endeavour is to get as near as we can to normal position while making sure that we do nothing to cause delayed union.

Causes of delayed union

We have seen that the first stages of repair are carried out by the blood capillaries which invade the blood-clot at the fracture site. The first cause of delay in union is a poor blood supply This can arise from several causes

(1) There may be a normally poor blood supply to the part. A good example of this is at the lower end of the tibia fractures in the lower third of the tibia are always slow to unite owing to the poor blood-supply there.

(2) The fracture may be transverse. In this case there is a large amount of cortex at the bone-ends This outer hard part of bone has a very much poorer blood supply than the softer inner part or *cancellous* bone. In an oblique or a comminuted fracture much more of the inner bone is exposed and union is much more rapid

(3) A large fragment in a comminuted fracture may have been torn completely away from the periosteum and thus lose its blood-supply We have seen that a comminuted fracture usually unites rapidly but obviously this will not occur if one big fragment is completely deprived of its blood-supply In a closed fracture the dead bone is not a septic sequestrum, and if the fracture is kept still for long enough the bone-cells will grow into the dead fragment and incorporate it into the new bone again In the early stages after a fracture, the rich blood supply of repair reduces the calcium salts in surrounding bone, and a dead portion can be spotted because it does not show this early decalcification on X ray

(4) The blood supply may be reduced because of disease. Syphilis and yaws cause a narrowing and thickening of blood-vessels so that the blood-supply is reduced therefore a bone

After the capillaries have joined across the fracture and some new connective tissue has been laid down, the bone cells grow in to form a callus. The bone-cells cannot do this if there is constant movement at the part. So the second cause of delayed union is inadequate fixation. If the bone-ends are constantly allowed to move on each other, even though the movement is very slight, fibrous tissue will be laid down instead of callus As long as the bone-ends still have a good blood-supply it is still possible to get bony union by proper fixation, but if the movement is allowed to continue for months, then the bone-ends slowly become hard, like the cortex of normal bone. Any chance of healing will then cease and *non union* will occur

The third cause of delayed union is distraction of the bone ends In some fractures the best way of obtaining reduction and fixation is by a constant pull on one of the fragments. This is known as *traction* It is possible to apply too much weight in treatment by traction, and in this case the bone-ends will be *dis*tracted or separated. It has been found that even though this is discovered soon and the weight is reduced, some damage has been done to the bone cells of the soft callus and union becomes delayed.

The fourth, and last, main cause of delay in union is infection, and this rarely occurs except in compound fractures Everything must be done to prevent infection and to treat it, if it occurs for union will not begin as long as infection is present. In fact, if an infected compound fracture is being treated it is not necessary to restore position exactly until infection has been overcome.

Causes of non union

Non union is fortunately rare. Its causes are, firstly the causes of delayed union if these are not properly treated and, secondly the separation of the bone-ends by soft tissues.

TREATMENT OF FRACTURES

Good treatment is based on a knowledge of pathology and the processes of repair We have already considered how complicated these are in fractures, but we should now have a fairly clear

picture of the processes so that we can consider the general lines of treatment under several headings

Treatment of closed fractures

The aims of treatment of closed fractures are to relieve pain, replace the bone-ends in their proper position if they have been displaced (reduction of fracture) maintain the bone ends in position until they have united (fixation of fracture), prevent stiffness in surrounding joints and, finally, restore function to as near normal as possible.

If any of these are neglected there is a definite risk that either delayed union, non union or mal union may occur (Mal-union means union with some deformity still present.)

First aid

A patient has a history of an injury and is in pain. If an open wound is present, haemorrhage must be stopped and in a badly damaged limb this *may* require a tourniquet. The next step is to relieve pain morphine should be given if it is available. In a mild fracture splinting becomes easy, but if there is a severe fracture of a limb with abnormal movement at the fracture site, then extreme gentleness must be used both to avoid pain and to prevent any sharp ends of bone from puncturing the skin and making the fracture compound. In a bad fracture of the limb, the best way to reduce pain and prevent any movement while a splint is being applied, is to grasp the end of the limb firmly but gently at the wrist or ankle, and then pull gently but steadily With traction applied in this way the limb can be safely lifted and moved around so that someone else can apply a splint.

Hospital treatment of closed fractures

The diagnosis of a fracture is confirmed either clinically or by X ray If there is deformity this is reduced under an anaesthetic, and the fracture is fixed in position so that it cannot move. If there is any danger of compression of blood-vessels or nerves by the fracture, reduction must be made early but if the patient is quite comfortable there is no harm in delaying reduction for a few days until the swelling that results from injury has subsided. Sometimes reduction cannot be made by simple manipulation,

may be needed. Traction is applied if a limb is injured, the limb is splinted and the patient is transported gently to hospital.

In hospital operative treatment will be required. Immediately on admission, the tourniquet is removed and it is only replaced if serious haemorrhage recurs shock is treated by raising the foot of the bed and giving any necessary intravenous plasma substitutes or blood the dressing and splints are left undisturbed.

In the theatre the patient will be anaesthetized and the limb cleansed. If a major artery has been divided a tourniquet may be needed again during this process but it should be removed as soon as the vessel has been identified and both cut ends have been ligatured. The wound is then carefully excised, and all bruised and damaged tissue removed, including any completely loose fragments of bone.

The bone-ends are placed in the best possible position, but no plates or screws are inserted to hold them there, as it is unwise to put any foreign body into a compound wound. If it is felt that the wound is clean enough and that there will not be undue tension the wound is sutured, otherwise it is left open An open wound is packed with soft paraffin gauze a stitched one is dressed with the same dressing and then a plaster of Paris cast is usually applied.

The plaster must, of course, be applied over a padding of cotton wool, or split for its whole length or applied only as a splint on one side of the limb

Infection may be partially prevented by filling the wound with sulphonamide or penicillin powder but these powders may delay healing and the drugs are better given by injection or by mouth so as to reach the general circulation.

On return to the ward the limb is elevated the circulation is carefully watched and anti bacterial drugs are continued.

If everything proceeds satisfactorily infection will rapidly be controlled all swelling will subside, and at the end of three weeks the patient can be taken back to the theatre Here the fracture is reduced to the best possible position if the position is unsatisfactory stitches are removed or if the wound has been left open the wound is stitched by secondary suture or skin-grafted and finally a skin tight (unpadded) plaster is applied

In some cases however despite all care, infection or osteomyelitis of the bone develops. There will be a free discharge of pus from the wound and this will continue until the dead ends of the

bone have been sequestrated that is cast off from the living bone by the body A piece of bone cast off in this way is called a sequestrum This process may take two or three months or even longer and even after the bone ends have been sequestrated, infection will continue until the loose, dead bits of bone have been removed

Meanwhile union will be delayed. It will be necessary to keep the bones in a good position, but the position need not be perfect. The plaster is kept on until no one can stand the smell any longer it is then changed for a fresh one, and this process is repeated until either loose bone is found in the wound or an X ray shows that a loose sequestrum of dead bone is present. When the last portion of dead bone has been removed, the best possible position is obtained and the bones and soft tissues are allowed to heal At each plaster change the wound is re-dressed with soft paraffin gauze, but sulphonamides or penicillin by mouth or injection are stopped as soon as the temperature chart or the patient s general condition shows that the acute invasive stage of infection has been conquered.

Treatment of delayed union

The treatment of delayed union is simple. As long as X-rays *show that the bones are in good position* and that the ends have not become rounded-off and hardened, fixation is continued. The cause of delay is sought and treated for example, blood tests will be made for yaws or syphilis and appropriate treatment given, sequestra will be removed when they become loose, and acute infection will be controlled by drugs

Whatever the cause, the main line of treatment is *to keep the bone-ends from moving* by adequate fixation until they unite.

Treatment of non union

If delayed union has not been properly treated, non union may occur Once the X rays have shown that this has happened the only possible treatment is by operation.

The hard bone-ends are removed to provide a fresh blood supply the bone-ends are brought together and then they may be joined together by a metal plate or even better by a bone-graft. This is a piece of bone from another part of the body

If there is no sign of any return of circulation in twelve or twenty four hours an amputation will probably be necessary

If we are lucky, the circulation will slowly return through the collateral vessels and even if their circulation is not sufficient for the whole limb the patient may be fortunate and only have to lose some fingers or toes from gangrene, instead of the whole limb

INJURIES TO JOINTS

Compound injuries

When a joint has been opened by an injury very great care must be taken to prevent infection, because a septic arthritis is a very serious complication and may lead to permanent, painful stiffness of the joint. It may involve loss of the joint cartilage and fixation of the two bone-ends across the joint space. This is known as an ankylosis. The ankylosis may be 'fibrous', if it is caused by adhesions of dense fibrous tissue, or 'bony if actual bone union has occurred

The damage to the joint may be shown by a flow of synovial fluid from the wound but in any case the wound in the capsule should be discovered when the wound is explored during the process of surgical excision.

If the wound is of short duration and appears to be very clean, then both joint capsule and skin may be stitched but if there is slight doubt about the safety of doing so the capsule should be left unstitched and only the skin closed. If infection is probable, the whole wound should be left open.

Sulphonamides should be given by mouth or penicillin by injection, to all cases of compound joint injury until it is obvious that the risk of serious infection has passed

Small joints are treated by rest in plaster of Paris splints, but larger ones are best treated by traction to keep the joint surfaces separated. The traction is obtained by strapping applied to the sides of the limb and fixed to the end of a splint or attached to a weight by a cord which passes over a pulley or over the end of the bed.

While the affected joint is kept at rest, all the other joints in the limb must be fully exercised so as to prevent them from becoming stiff to keep up the tone of the muscles and to reduce oedema of the limb

The splints and traction are removed after the wound has healed and any infection has been controlled. In the majority of cases the interior of the joint will be perfectly healthy, but the joint will be stiff from tightening of the capsule round the joint and adhesions in the soft tissues. This stiffness may be overcome by careful exercising. During the exercises concentrated effort by the patient on the stiff parts themselves is much better than attempts to manipulate the joints either with the patient's own hands or with someone else's. In fact stretching of the joint by someone else may simply cause more damage and an increase of stiffness.

If septic arthritis has occurred, then some or all of the joint cartilage will be destroyed and adhesions will form between the bone-ends. Slight adhesions may be stretched by the patient's exercises or may be broken by one sharp movement under an anaesthetic. More extensive adhesions give rise to a fibrous ankylosis. This allows a little movement, but the movement is always painful and the patient is severely handicapped. If the adhesions are too dense to be broken down by exercises or manipulation and if pain is severe, then the best treatment will be to excise the whole of the joint surface by cutting off the bone-ends with a saw. The new bone-ends are brought together and allowed to unite in a good position. When a bony ankylosis is made in this way by a surgeon the operation is known as an *arthrodesis*.

If there has been really severe destruction of the cartilage, then the bone-ends will be able to come together and unite by themselves forming a bony ankylosis. When it seems obvious that the infection is severe enough for this to occur the surgeon must make sure that the ankylosis occurs in the best possible position for future function of the limb.

Closed injuries of joints

In the simplest form of closed joint injury there is a mild sprain of the joint capsule and surrounding ligaments. This is accompanied by bruising of the synovial membrane. The joint feels painful and there is increased pain if any attempt is made to move it. The synovial membrane secretes synovial fluid which causes the joint to swell. This will be most noticeable in the knee joint, where the surrounding tissues are very loose.

If the injury is very slight we talk of a sprained joint, while if a lot of fluid is present we talk of a traumatic arthritis or a traumatic synovitis. The joint will respond rapidly to rest, but if there is much effusion it should be aspirated and a firm bandage applied in order to prevent more fluid from collecting

Sometimes the synovial membrane is sufficiently damaged for it to bleed freely into the joint and form a *haemarthrosis* A haemarthrosis causes swelling of the joint almost immediately after the injury while a simple effusion takes a few hours to develop If there is any possibility of a haemarthrosis being present it is essential to aspirate the joint at an early stage and repeat the aspirations if fluid forms again. If the blood is left in the joint it will coagulate and be converted to fibrous tissue, which increases joint stiffness.

Damage to ligaments

A very slight tear in a ligament is known as a *sprain* and this responds rapidly to rest followed by exercise to restore movement after the acute phase is over During examination the most tender spot will be found to be over the ligament and not over bone, unless it is at the point where the ligament is attached to bone.

If a ligament is torn right across abnormal movement of the joint will be permitted. If the injury is really severe, one bone may be completely moved away from its normal position in relation to the other bone of the joint, causing a *dislocation* Pain will be severe and will continue until the dislocation has been reduced With an injury as severe as this effusion will naturally be considerable, and stiffness after prolonged rest will be great. Careful treatment, however should give a good result.

Sometimes the ligaments are too badly damaged to repair themselves properly or the patient may exercise the joint before they have fully healed. In these cases the joint will be permanently weakened and a recurrent dislocation may occur on a slight strain.

The ligaments may be torn on one side of a joint, but the force of the injury may not be sufficient to dislocate the joint. The joint can then be forced into an abnormal position which should normally be prevented by the ligament. An X ray or the feel of the examining hands, will show that the bones have moved

away from their normal close contact. This is known as *sub-luxation* An example can be given here in the ankle in the normal ankle joint the talus moves only upwards and downwards and has no sideways rocking movement. If either the medial or the lateral ligaments have been torn sideways subluxation will be permitted

Treatment

If a joint is dislocated the dislocation must be reduced and the joint is then rested until the ligaments have reunited. Fixation by plaster of Paris is usually unnecessary but the upper limb should be placed in a sling and the lower one on a splint. In the case of the ankle a walking plaster can be applied after the swelling has subsided. If there is only a sprain, strapping with elastoplast will suffice.

Intensive exercises are given to the surrounding muscles, otherwise the joint may remain weak and subject to recurrent strains with the development of a chronic traumatic synovitis.

Complications

The important complications are infection of a compound injury haemarthrosis ankylosis or the presence of a fracture which enters a joint. In the last case, reduction of the fracture must ensure that the joint surfaces are left smooth and that no projecting portions of bone are left in the joint which could cause arthritis later

CHAPTER 8

INFECTION—GENERAL PRINCIPLES

Pathology

INFECTION is caused by the invasion of the body tissues by organisms. The great majority of surgical infections arise from invasion by bacteria, which are small one-celled organisms visible through a microscope. There are occasional cases of infection by *viruses*, *protozoa*, *helminths* or *fungi* whose effects may result in surgical conditions, although their original infection of the body is more often of medical interest.

Viruses are so small that they cannot be seen with an ordinary microscope, the only one of real surgical interest is the virus of acute poliomyelitis

Protozoa are larger organisms which are composed of single living cells with a distinct nucleus The only one of surgical interest is the Entamoeba histolytica of amoebic dysentery

Helminths are organisms which are even further developed, being composed of many cells and having a mouth, an intestine and other body systems They multiply by laying eggs. The helminths of surgical importance are the Bilharziae, which invade the walls of the bladder or rectum, and the intestinal worms which very occasionally cause intestinal obstruction

Fungi are forms of vegetable life, a few of which are capable of invading the body and causing disease. Examples are mycetoma and actinomycosis

An organism which is capable of invading the body and causing trouble there is said to be pathogenic a large number of organisms are non pathogenic, but we are not interested in these.

It will be seen, then, that in surgical practice we are chiefly interested in the pathogenic bacteria.

Pathogenic bacteria

These are further subdivided into cocci and bacilli and a very small class of spirochaetes which are responsible for yaws and syphilis. Cocci appear under the microscope as small round

dots, sometimes in clumps (for example staphylococci) and sometimes in chains (for example streptococci) Bacilli are small rod shaped organisms There are many distinguishing features whereby the pathologist can tell one variety from another, but here we will mention only two of these features which appear frequently in laboratory reports

The first is the effect of staining bacteria with Gram s stain. After the use of this stain some cocci appear purple in colour and some appear red. The first are called Gram positive organ isms and the second Gram negative. Staphylococci and streptococci are both Gram positive gonococci are Gram negative.

The other test is used in the search for tubercle and leprosy bacilli In this case the bacilli are stained with a dye and an attempt is then made to remove the dye with acid This cannot be done in the case of tubercle or leprosy bacilli, which are therefore sometimes called acid fast bacilli (or A.F B)

Mode of entry into the body

Pathogenic bacteria enter the body either through a break in the skin surface such as a scratch or wound, or else through an intact mucous membrane such as that of the throat or the in testines Pathogenic bacteria frequently live in the throats and noses of people without causing any harm to them but they can be transferred to other people by being breathed into the air or transferred to the fingers and then to wounds The numbers of pathogenic bacteria in the air in a well ventilated place, are very few but they naturally increase in crowded conditions and the bacterial population in the air will become very much greater in a septic surgical ward, especially just after beds have been made blankets shaken and the floor swept. No dressings should be done in a surgical ward until a full hour after these activities are over and every care must be taken to prevent the *cross infection* of one wound with organisms from another (see Chapter 39)

Bacterial invasion

Once bacteria have gained entry to the body they multiply every few minutes and as each bacterium divides to make two and each

two to make four, and each four hundred to make eight hundred, the population increases at a great rate

The body responds by the process known as inflammation and the battle between the bacteria and the body has started If the infection is by a large number of bacteria or the organisms are very powerful (virulent) the infection may kill the patient before his defences have been able to provide any protection. This is known as a fulminating infection. On the other hand the infection may be very slight, the bacteria of low virulence, or the body's defences may have been previously prepared by former infection so that the infection is rapidly overcome without the aid of any surgical treatment or drugs The disappearance of infection is known as *resolution* of the infection. It may also be said that the infection has resolved

Very mild infections are frequent, but they are so mild that the patient does not require to visit a doctor or hospital for their treatment although, with throat infections there is a risk that he may pass the disease to others who are less resistant, while he continues at work.

Bacteria grow and multiply best in the presence of dead tissue from which they can obtain the nourishment necessary for their existence. In order to obtain this dead tissue they produce toxins which are their chief weapon of attack.

These toxins have an important local effect because they are able to destroy living tissue cells and also the leucocytes which the body provides as one of its defence lines Some bacteria have the power of turning the dead tissue and leucocytes into a liquid which will also contain dead bacteria. This liquid is known as pus, and the bacteria which can form pus are known as *pyogenic bacteria*

Some bacteria also have the power of destroying red blood-cells, and these are known as haemolytic bacteria. The haemolytic streptococcus is the most important of these, and a severe infection with haemolytic streptococci is one of the most deadly that we can meet.

The toxins do not have a purely local effect, but are able to spread through the whole body in the circulatory system and give rise to general *toxaemia* that is the general signs of infection, such as a raised temperature, increase in the pulse-rate and possibly headache and loss of appetite. A person who is suffering from severe toxaemia looks very toxic and ill. The rise in tem-

perature may be so sudden that the patient has a shivering attack while he tries to keep the heat inside the body—this is known as a *rigor*

Not only do the toxins escape from the original area of infection, but the bacteria may be able to do so also. While they are destroying the surrounding tissues with their toxins they may penetrate lymph- or blood vessels. In the lymph vessels they may travel to the nearest lymph-glands and give rise to lymphadenitis. The spread will be encouraged by movement.

Invasion of veins gives rise to a local thrombosis, and infection may spread no further. On the other hand small clumps of bacteria may break off from the blood-clot, causing a *pyaemia*: these clumps may then be carried by the blood stream to other parts of the body and cause abscesses there.

Sometimes sufficient bacteria enter the blood-stream for them to be able to grow and multiply there. This is known as a *septicaemia* and it is more common in infection caused by haemolytic organisms than in infection by non haemolytic ones. A septicaemia is a very grave illness, the fever is high, possibly reaching 104° to 105° F every evening for several days and, if the infection is really fulminating, death may occur in a very short time, possibly in two days or less.

Thrombosis in small arteries caused by the toxins will lead to further death of tissue, providing more food for the bacteria.

It is the moderate and severe cases of infection which come to the doctor for treatment, and it is in these cases that we are able to help the body to fight back against the invasion. Fortunately the sulphonamide drugs and antibiotics have now made even very severe infections much less dangerous. The result is that infection is no longer one of the major causes of death, as long as the patient comes for treatment early enough. The chief causes of death nowadays are injuries, malignant tumours and the degenerative diseases of old age.

The body's response to infection

You will notice that in the last paragraph it was said that we are able to help the body to fight back. That is the whole purpose of treatment—we help the body to fight, we do not fight its battles for it. If we did, the body would build up no resistance and, the moment we stopped fighting, infection could flare up

again We must therefore understand the body's natural mechanism of resistance.

The local response is known as inflammation. This response is also seen as a result of simple injury, for example cuts or burns, when it provides a defence against possible infection If no infection occurs the inflammation quickly subsides or resolves

The injury or infection causes the release of histamine from the damaged tissues and this has an immediate effect on the surrounding capillaries They become dilated, causing local *heat* and *redness* This can be seen to develop within a few seconds by scratching a white skin with the blunt end of a pin. This injury is so slight that the inflammation rapidly resolves but if the injury is more severe, or if infection is present, the next stage develops.

In the second stage there is a *slowing or stasis*, of the blood flow in the capillaries. The capillary walls weaken and the fluid plasma is able to escape into the surrounding tissue. This causes the next sign of inflammation—swelling or *oedema*. If the swelling becomes more severe the last two signs of inflammation will appear these are *pain* from pressure on nerve-endings and *loss of function* arising partly from the pain and partly from the stiffness resulting from the swelling

This exudate of fluid into the tissues is the first line of defence. The fluid contains antibodies which are able to neutralize toxins and kill bacteria the fluid also contains fibrinogen, which can be converted into fibrin and thus try to make a barrier round the infected area. The pain and loss of function from the swelling result in the part being kept at rest by the patient, and this helps to prevent the spread of infection by the lymphatics.

Not only does plasma pass out of the capillaries but leucocytes collect along the walls of the dilated capillaries when the flow of blood has been slowed, and then actually wriggle their way through the capillary walls, moving like amoebae. Once in the tissues they also attack the bacteria and absorb and digest them, especially if the bacteria have already been killed or damaged by antibodies If there is liquefaction and pus formation an *abscess* results the walls of an abscess are composed of a concentration of the body's local defences antibodies in the plasma exudate, leucocytes fibrin and fibrous tissue.

Some antibodies are present in the body naturally some have arisen from the stimulus of previous infection, and still more

appear during the course of the infection due to the effects of general toxaemia.

Once the infection has been overcome, the body will attempt to repair the damage in the same manner as it repairs wounds. Capillaries and fibroblasts grow into the clot of fibrin and form fibrous, or scar tissue.

The general toxaemia also results in a stimulation of the bone marrow and the production of a greatly increased number of leucocytes This is observed by a rise in the total white blood cell count. The leucocytes are, as you know of three main varieties and these appear to have different functions in defence. The differential white count will show their proportions in the blood, and it will be noticed that acute infections usually stimulate an increase in the polymorphs tuberculosis and some other chronic infections cause an increase in the lymphocytes and infection by protozoa and helminths causes an eosinophilia.

Summary

The signs and symptoms of infection are redness, heat, swelling pain and loss of function There may also be general toxaemia, pyaemia or septicaemia.

The body's defences are antibodies leucocytes fibrin formation and rest.

In severe cases the bacteria can cause death from toxaemia.

In less severe cases the body wins the fight, but before it does so there will be some local destruction of tissue, which may be small and easily repaired by scar tissue or may be severe, resulting in death of skin or soft tissues (gangrene) or of bone (necrosis or sequestration)

Dead soft tissue is called a *slough* and dead bone is called a *sequestrum*. Infection will continue as long as sloughs or sequestra are present and, if the dead tissue lies under the skin pus will discharge to the surface along a *sinus*

A *fistula* is a sinus which has two openings, one to the skin and the other to the bowel, bladder or other cavity or between one cavity and another The great majority of fistulae are caused by infection but they can also arise between the stomach and intestine as the result of the perforation of a peptic ulcer or between the bladder and bowel, or the bronchi and the pleural cavity as a result of the growth of a malignant tumour

Treatment of infection

The general principles of surgical treatment of infection are to encourage the body's own efforts, relieve pain, prevent future disability and to supplement this treatment with specific drugs when indicated.

The first treatment required is *rest*. This not only reduces the chance of the infection spreading, but also helps to relieve pain by reducing movement. Rest, like medicines, must be prescribed in definite instructions to the patient. A very mild finger infection may only require the rest given by a dressing and bandage while the patient continues at work; more severe infections may require the addition of a sling or a splint and a really bad infection will have to be treated by rest in bed. Bed rest may be complete or the patient may be allowed up for short periods at a time. It is prescribed more frequently in infections of the lower limb than of the upper limb because of the difficulty of resting the lower limb while out of bed.

The second treatment is *elevation*. We have seen that the swelling which appears during inflammation is of benefit to the body because it is caused by the exudation of plasma from the capillaries. Unfortunately the body is not always able to control the amount of swelling and excess swelling will result in pain. Not only will pain be caused, but an unnecessarily large amount of fibrin will form in the oedema fluid and this will give rise to later stiffness. Elevation will permit the draining away of excess fluid.

The third treatment is *movement*. This appears to contradict the first treatment, but, as in the treatment of fractures, it is designed to prevent future stiffness. It is quite possible to keep one septic finger at rest by plaster or other splinting and yet carry out vigorous exercises for the other fingers. If this is not done the results are often disastrous. The patient is left with an almost useless hand, with every joint stiff and every finger swollen, and many months of hard exercises may be necessary to correct the disability.

Once the acute infection has been overcome the actual injured or infected part must itself be given an increasing amount of exercise, and it must again be remembered that it is the patient's own exercises that will do more good than any passive movement carried out by someone else.

The three main principles of treatment of infection are therefore rest, elevation and exercise.

Dressings

In the early stages of inflammation external heat may be applied. It is soothing to the patient and will also increase the circulation and bring more antibodies and leucocytes to the site. Hot fomentations are no longer used. The heat provided lasts for only a very short time, and the boracic in pink lint has no effect on an unbroken skin.

If the inflammation is near the surface the best dressing is an application of a kaolin poultice, which should be applied as hot as possible, without burning and changed every four or eight hours. If the inflammation lies in deeper tissues it may be reached by the rays of an infra-red lamp or the very short waves of a diathermy apparatus (short-wave diathermy)

These methods are also used to improve circulation in the later stages when stiffness is being treated exercises are very much easier after there has been an improvement in the circulation.

When dead tissue has formed as a result of the inflammation it must be removed either by being cast out by the body or by operation. While this is being done care must be taken not to let in infection by other bacteria. We shall see that this is particularly important in the case of tuberculosis where the toxins seriously damage the surrounding tissues, weakening their resistance to fresh infection and very grave consequences result from secondary infection by pyogenic organisms

Abscesses require to be incised and sloughs or sequestra removed. It is most important not to incise an infected area too soon. The purpose of an incision as a rule, is purely to let out pus, and an incision before pus has formed will only cut through the defensive wall that the body is trying to form and possibly allow a spread of infection. The presence of pus is demonstrated by fluctuation of the part. Gentle pressure on one area will be transmitted through the fluid and can be felt by a finger resting on another area of the inflammation.

When an inflammatory focus has been opened it should as a rule be left open to drain. Much better results are obtained if a good wide skin incision is made instead of a small stab into which

is pushed a piece of rubber drainage material. A big incision allows one to remove most of the dead tissue at once and if the abscess is big enough a finger can be inserted and swept round to bring out loose tissue The wound should then be packed open and treated as an infected wound Too often one sees abscesses which have been treated by small stabs in which the drain that has been put in simply acts as a plug in the drainage hole, holding in pus and sloughs A general anaesthetic is usually required for an adequate incision to be made.

Infected wounds and opened abscesses

A variety of dressings are employed in these cases, the best are those which have the power of absorbing water and serum and thus drawing the serum out of the wound As the plasma passes out fresh plasma and fresh antibodies will enter from the circulation

Dry sterile gauze packed into the wound is very effective, but its power of absorption can be increased by moistening it with 45 per cent. magnesium sulphate in glycerine. An equally good, and very much cheaper dressing is a strong solution of salt. This is made up as a 20 per cent. solution and is known as 20 per cent. saline It can be made up in any dispensary by putting a large quantity of ordinary salt in a bottle of water and leaving it for twelve hours shaking the bottle occasionally The water will dissolve all the salt that it can and leave the rest on the bottom of the bottle. If more salt has been put in than can be dissolved the solution that results is about 20 per cent. and it can then be poured off into another bottle.

Acriflavine or proflavine is also frequently used in a strength of 1 1 000 but it is not as good as 20 per cent. saline. The acri flavine can kill bacteria on the surface, but cannot attack the bacteria in the walls of the abscess and it cannot draw out fluid. It is not therefore of very much use in the presence of pus Furthermore, if it is used repeatedly for several days, it will damage tissue cells and delay healing

Eusol is another popular remedy and it is almost as good as 20 per cent. saline. To get its maximal effect however it should be changed every three or four hours or used as a continuous irrigation.

Frequent hot baths were often used in the past as a substitute

for fomentations, but they have three bad effects which have now made them unpopular They make the skin and tissues soft and moist, thus encouraging infection they can only be applied to a limb which is allowed to hang down and therefore they encourage oedema and the bath may be contaminated with organisms from the last person who used it, thus increasing the risk of cross-infection

Specific drugs

All the treatment given so far has been designed to help the body to overcome the infection, and no further treatment is required in a large number of cases

If however, infection is severe it may be possible to shorten the course of the illness and possibly save life by killing off a large number of the bacteria with drugs It is never possible to kill all of them in this way and the final cure will depend on the patient's own immunity He may have some immunity at the start of the illness and this will be increased during the course of the infection

The two principal groups of anti bacterial drugs are the sulphonamides and the antibiotics Some of these function by actually killing the bacteria, and others by slowing down their rate of growth and multiplication which gives the natural resistance a better chance.

Sulphonamide drugs

There are many sulphonamide drugs, each of which has proved to be more effective than those previously discovered or else to have the power to control a different group of bacteria. The best at the moment for general purposes is sulphamezathine and, for the treatment of bowel infections, sulphasuxidine or succinyl sulphathiazole.

The drugs are given at four hourly intervals in order to maintain a high level in the blood or in the intestine, and it is wise to start with double the normal dose in order to obtain a sufficiently high level. The adult dose for the sulphonamides of general use is four tablets to start with and two every four hours thereafter while those that will remain in the intestine and have most of their action there, are given in three times that dose

Sulphonamides are *extremely useful*, but they have their

dangers. Very occasionally they may cause blockage of the kidneys and suppression of urine, although I have never seen this happen with the newer drugs. As a precaution all patients receiving sulphonamides should be made to drink at least six pints of fluid a day, and they should also take a mixture of potassium citrate to make the urine alkaline.

The drugs may also have a toxic effect on the patient, they may cause skin rashes and what is even more serious, they may depress the function of the bone marrow and cause anaemia and death from suppression of the formation of leucocytes In the latter case the body's main defence against infection has been destroyed, the patient then dies of an infection often of the throat, having been killed by a drug which was meant to save him from infection

Finally some organisms are naturally resistant to these drugs, and even those which are sensitive can become resistant if they are exposed to the drug repeatedly or for a prolonged period.

The lessons from these dangers are that the sulphonamides should never be given for mild infections that the body can deal with itself they should never be given repeatedly for the same infection, they must always be given in adequate doses so that they can have their full effect in the shortest possible time, they should never be given for more than five days if they are having no effect, and they should never under any circumstances, be given for longer than three weeks.

Antibiotics

This is the name given to chemicals which have been extracted from one type of living organism and which have the power of stopping the growth of or destroying other living organisms

The first of these to be discovered was penicillin. It is still quite the best of them all for all general purposes and it is now produced in such quantities that it is relatively cheap It is almost completely non toxic to the human body, unless the patient has previously received the drug and become sensitive to it, and it acts against the great majority of organisms. Its only real defects are that, like the sulphonamides, it also can cause drug resistance in sensitive bacteria if it is used when not properly indicated It is also ineffective against some types of organisms

Like sulphonamides, penicillin should not be used unless the severity of the infection requires it, it should be given in adequate dosages and it should not be used for more than five days if it is having no effect. On the other hand if it is having an effect it can be used continuously for prolonged periods

There are far fewer resistant organisms in the hospitals in Africa than there are in the hospitals in Britain and it is found that smaller doses are often quite sufficient compared to the very big dosages now recommended in most text books The dose will vary with the severity of the infection. Moderate infections can be controlled by the daily injection of 100 000–200 000 units of a mixture of soluble and procaine penicillin, more severe infections will require 400,000 units daily, while really severe infections are best treated by repeated injections of soluble penicillin The dose in this case will vary from 50 000 units four hourly (300 000 units a day) to 200,000 units four hourly (1,200 000 units a day) and, as with sulphonamides the first dose is usually doubled. Some people have found that 500 000 units given twice a day (1 million units daily) are as effective as 300 000 four hourly (1,800 000 daily)

As so few Africans have had repeated small doses of penicillin, sensitivity to the drug is also rare at present.

Streptomycin and chloramphenicol are other very useful antibiotics especially for use against the tubercle bacillus and in typhoid fever, respectively they and the other newer antibiotics such as aureomycin may also be used against organisms which the laboratory has shown to be resistant to penicillin but sensitive to the other drug They are all very much more toxic and very much more expensive than penicillin and they should not be used unless there are very strong indications for their use.

Prophylaxis

Apart from the treatment of actual infection both sulphonamides and antibiotics may be used before and immediately after operations in order to prevent the possibility of infection. This should not be necessary if proper aseptic precautions are taken in the operating theatre and the drugs are rarely used except when infection might have serious consequences for example in operations on bone.

Summary

The treatment of infection is rest, elevation, exercise local heat, removal of pus or dead tissue, and restoration of function. Sulphonamides and antibiotics may be used in addition if infection is severe.

CHAPTER 9

ACUTE INFECTION

ACUTE infection is characterized by a sudden onset, a rapid invasion by organisms, a quick response by the body and an early termination. Sometimes, however, the infection may persist as a chronic infection, especially if dead tissue is left in the body. Treatment does not end with the control of infection, but only when the maximum possible return of function has been obtained.

The most common organisms which give rise to acute surgical infections are the Gram positive pyogenic cocci and a number of bacilli, including the pseudomonas pyocyanea, which gives a green colour to dressings. Less common organisms are the anthrax and tetanus bacilli, the mixed infection of tropical ulcer and the virus of poliomyelitis.

In this chapter we shall consider different types of tissue that may be involved and, in later parts of this book, we shall deal with the effects of infection on different parts of the body.

THE SKIN

Boils

A boil is a very small, local, acute infection *within* the skin usually caused by the staphylococcus. It is far less common in tropical Africa than in Europe, and there are many Africans who have never suffered from one. The infection usually enters at the base of a hair follicle. Boils are more common in the axilla and groin than elsewhere.

Inflammation commences within a few hours of the infection and there is soon a hot, tense, red, painful swelling. The skin cannot stretch easily and it is full of sensory nerve-endings, hence the tenseness and the pain that arise in what appears to be a very small lesion.

At the end of two to three days the boil bursts and discharges liquid pus on to the surface of the skin. This is followed after a few more hours or in another day or two by the discharge of the core of the boil, consisting of dead tissue. The relief from pain

caused by the discharge is so great that the patient is tempted to squeeze the boil in order either to get it to burst earlier or to squeeze *out the core*. There are two good reasons why this should not be done. The first is that squeezing may force infection through the body-barrier of fibrin and leucocytes and cause a spread of infection and the second is that infection will get on to the squeezing fingers and may be transferred to another part of the body Unless the boil is covered with a dressing the temptation to squeeze it will be very great.

After the boil has burst, healing is rapid There will be no scar unless the boil was big enough and deep enough to have penetrated the full thickness of the skin

The pus, however, may have been spread over the skin surface, either during natural discharge, after squeezing, or on soiled clothing and the first boil may be followed by one or two more in near by hair follicles This will be more likely to happen if the skin has been kept moist by wet dressings or a large adhesive dressing

A boil is best dressed by a small piece of dry gauze, covered with elastic adhesive strapping which should cover as little of the normal skin as possible. The surrounding skin should be painted repeatedly with acriflavine or gentian violet in spirit to destroy any bacteria on the surface. Sulphonamides or antibiotics are not indicated unless the patient has a very low natural resistance and so suffers from a series of repeated boils. If this occurs everything must be done to strengthen natural resistance by providing a nourishing diet and correcting anaemia.

Carbuncle

A carbuncle is a stage worse than a boil. The deeper layers of the skin have become infected, and there is death and sloughing of these layers. Pus forms and escapes through a multitude of sinuses. The more superficial layers of the skin may then slough, leaving an ulcer

Carbuncles are particularly common in diabetic patients, and the urine should always be tested for sugar if a carbuncle is present. Both the carbuncle and the diabetes must be treated if the latter is present, but it must be remembered that infection will make diabetes worse, and the urine must be tested regularly for the amount of sugar present. As the infection is overcome the

need for insulin becomes less and if the urine is not tested regularly the patient may be given an overdose of insulin after the infection has been overcome.

Carbuncles are treated by the application of *magnesium sulphate and glycerine* or 20 per cent. saline dressings and appropriate doses of penicillin are given. After the skin has sloughed off, the dressings are continued until the ulcer is clean If it is small it will be healed by the ingrowth of epithelium from the edges, but if it is large a *skin graft will reduce the healing time.*

Anthrax

Anthrax is another infection of the skin. It is caused by the anthrax bacillus which may be found in a sleeping form (spore) in infected hides and skins A person carrying such a skin on his shoulders may get a scratch on the shoulders neck or arms or elsewhere, and this scratch may then become infected. Within a few hours or possibly not for two to three days, infection develops from the bacilli which have awakened from their spore form A thick, hard, tender *pustule* develops and this is surrounded by a zone of inflammation, usually not more than about an inch in diameter There is a general toxaemia, but fortunately this is rarely grave in Africans. The severe form found in Europe has given rise to the name of malignant pustule for the condition.

Anthrax may also infect the bowel when infected meat has been eaten or it may get into the lungs and cause pneumonia but these are not surgical conditions.

The pustule is dressed like a carbuncle and will slough off in a few days. In severe cases *penicillin will be advisable, as the* anthrax bacillus is sensitive to penicillin. Good results have also been obtained in moderate cases by the injection of 0 6 gram of *neoarsphenamine intravenously on two successive days*

Ulcers

An ulcer of the skin is an area of the body surface where the skin has been totally destroyed by infection or has been removed by injury and has then become infected. The most common infections which cause ulceration are those caused by the organisms of tropical ulcer syphilis yaws and tuberculosis (*see below and* Chapter 10)

Tropical ulcer

This is the most common skin infection in the tropics. The exact cause is unknown but it is extremely common in hot, moist climates being more common round the lakes and on the coast of East Africa than in high cool climates. It is also more common in undernourished patients than in healthy ones The original entry point appears to be a scratch or minor injury, especially on the lower limbs where the circulation is poorest.

Organisms enter the wound and multiply The organisms include the group known as *Bacteroides* the commonest of which is the *Bacteroides fusiformis* (Vincent s fusiform bacillus) These organisms cause a rapid local destruction of tissue and create a characteristically foul smell. The organisms are commonly present in the mouth and may give rise to gingivitis, the sloughing phagedaena of cancrum oris or phagedaena of the scrotum. Most of the bacteroides are sensitive to penicillin The infection very soon becomes chronic if it is not treated.

There are two problems in treatment. First of all the ulcer must be made clean and then it must be made to heal It can be made clean by the removal of infection and various treatments are equally effective, although some take longer than others

If beds are available the patient should be admitted for rest in bed and for the treatment of malnutrition and anaemia. The organisms are sensitive to penicillin, and the ulcer can be made clean in four to five days by giving the patient penicillin injections while the ulcer itself is dressed daily with 20 per cent saline. If penicillin is in short supply it is advisable to excise the ulcer The surface of the ulcer should not be scraped but a good slice should be removed with an amputation knife in the same manner as one cuts a slice of bread from a loaf Healthy tissue will then be exposed. If a Z I P.P (zinc iodoform paraffin paste) dressing is rapidly applied and the part firmly bandaged there is very little loss of blood. The dressing should be left on for five days to a week.

If the patient must be treated as an out patient, the ulcer can be cleaned in two to three weeks by a weekly application of Z I P.P and then covering the wound and dressing with plaster of Paris.

The Z.I.P.P and plaster of Paris treatment may be continued after the ulcer has become clean, and then the ulcer will slowly heal by the creeping in of epithelium from the edges. Unfortu

nately the skin that is formed is very thin and lies on a bed of scar tissue. The scar tissue contracts and reduces the blood supply to the thin skin and a fresh ulcer may readily form after another injury. Repeated breaking down and ulceration may eventually cause a malignant epithelioma.

Undoubtedly the best treatment for the healing stage of an ulcer is to restore the natural cover of skin as soon as possible, and this is best done by the application of a skin graft as soon as the ulcer is clean.

Chigoes or Jiggers

These are minute insects found in dusty ground. They are very much more common in some places than others. The female insect, laden with eggs, burrows into the skin of the toes and feet and slowly grows fatter until the eggs are ripe. Then the chigoe and the skin burst and the eggs are scattered on the ground.

While the chigoe is within the skin it gives rise to considerable irritation, but it can be removed easily with a sterile needle. It is not important whether the egg-sac bursts or not during extraction, as long as the whole insect is removed.

Chigoes are most commonly seen in mentally defective people or those who have become apathetic from ill health. In these cases long neglect permits secondary infection and septic ulceration to occur. If this becomes chronic, there will be an associated chronic lymphadenitis of the groin glands. Treatment must then be directed against both the secondary infection and the original chigoes.

SUBCUTANEOUS TISSUE

Cellulitis

Cellulitis is the name given to infection of the subcutaneous tissue. It may arise from a small puncture wound or the spread of infection from a larger wound.

The skin over the inflamed area is hot and there is a certain amount of pain and loss of function. Pain may not be as great as that from, for example, a carbuncle which arises in the skin because the loose cellular tissue under the skin allows quite a lot of swelling to take place before the tissue becomes tense. Besides there are fewer sensory nerve-endings in subcutaneous tissue.

If the infection is caused by pyogenic organisms, and early resolution does not occur an abscess will form. This can be demonstrated by fluctuation under the skin.

There are no special points about treatment. In the early stages the inflammation is treated by rest and the application of local heat by a kaolin poultice. Penicillin will be indicated if infection is severe. Once pus has formed, the abscess is opened freely and the wound is dressed with 20 per cent. saline

LYMPHATIC SYSTEM

Lymphangitis

The lymph vessels are the main drainage channels from the skin muscle and all other tissues In the early stages of an acute infection, bacteria may enter the lymphatics and cause an inflammation of the vessels. General toxaemia increases owing to the spread of bacteria into the body away from their place of entry Then, if the infection is close to the surface of a white skin the inflamed lymphatics may be seen as red streaks running up the limb towards the groin or axilla.

The treatment is concerned with the local inflammation which the lymphatics are draining As a lymphangitis suggests a low body resistance, or the presence of a virulent organism, sulphonamides or penicillin will usually be indicated.

Lymphadenitis

Lymphadenitis is an inflammation of the lymph glands into which the lymphatics drain. Within a few hours after infection they may become enlarged and tender especially if lymphangitis is present, but, if the virulence of the organisms is low the lymphadenitis may not appear until the infection has been present for several days. It may occur without any obvious inflammation of the lymphatic vessels If the infection is well localized by the body's defences, then no adenitis will appear at all.

An acute lymphadenitis is treated by local heat and possibly a sulphonamide drug or penicillin. It may then resolve or may develop into a groin or axillary abscess which will be treated in the same manner as abscesses elsewhere.

Repeated or persistent pyogenic infection may cause a permanent thickening of the glands which will be slightly tender

if any infection is actually present. A large mass of chronically inflamed glands may be excised after the original source of infection has been dealt with

MUSCLE

Myositis, or inflammation of muscle is uncommon except in the depths of an infected wound This is largely due to the very rich blood supply of muscle which rapidly deals with any blood borne infection, and also to the distance from the skin, which reduces the chances of infection from small injuries.

Very occasionally a bruised muscle may become infected from the blood stream, but the most common muscular infection in the tropics is *tropical myositis*

Tropical myositis

The exact cause of this disease has not yet been discovered. A painful tender and very hard lump appears in a muscle usually in the lower limb or the abdominal wall. The local inflammation is accompanied by a rise in temperature to 102° or 103 If the myositis is treated with local applications of kaolin poultices and either sulphonamides or penicillin from an early stage, resolution usually *occurs in two to three weeks* without *pus formation.* If pus does form it will be detected by deep fluctuation, and an incision will be required

Before sulphonamides or penicillin were available pus formation almost always occurred, but it did not develop until the end of about three weeks Sometimes the inflamed muscle was incised at an earlier stage owing to the persistent high temperature and to the suspicion that pus was present although too *deep for fluctuation to* be *found* In these cases a hard whitish muscle was found in which the blood-supply was obviously restricted. As we have said the exact cause of the condition has not yet been found, but it may be due to a *thrombosis in muscle* causing an ischaemic necrosis which then becomes infected.

BONES

Osteitis

An inflammation of bone, without pus formation is known as an osteitis This is commonly the result of chronic inflammation

especially from syphilis or yaws, to which the student should refer (See Chapter 10)

Osteomyelitis

Osteomyelitis is an inflammation of the bone and bone marrow tuberculous osteomyelitis will be referred to later and we shall discuss here pyogenic osteomyelitis.

This may be a sequel to a compound fracture, especially if dead bone is left in the wound The acute infection and toxaemia of an infected compound fracture should be treated and the dead bone removed, but sometimes it is wise to leave the dead bone for a few weeks, despite the offensive smell from the discharge of pus. This is because the removal of the bone may leave a large gap between the fracture ends whereas if the dead bone is left it can act as an internal splint while new bone grows down from under the periosteum on either side of the fracture, forming a case of new bone round the sequestrum. Dead bone should not be left in the region of a fracture for more than three months because of the risk of persistent infection, preventing union

Osteomyelitis is much more frequently seen as an acute, blood borne infection. The bacteria enter the body through the mucosa of the throat or elsewhere, and are carried round the body by the circulation for a short time before they are killed. Sometimes they may find their way into a small capillary towards the end of a bone and be arrested there. This is much more likely to occur if the bone has been previously bruised by some small knock, for example at play The small injury may cause a slight thrombosis in the bone capillaries, so that bacteria in the blood-stream are held up and begin to multiply in the clotted blood Children suffer from throat infections more frequently than adults and boys get injuries more frequently than girls while playing the result is that acute osteomyelitis is most common in boys aged about six to twelve but it can occur at all ages in either sex. Infection is most common close to the knee, either in the lower end of the femur or the upper end of the tibia.

The onset is usually very acute, with very severe pain and a high fever Bone can stretch even less easily than skin, with the result that inflammatory swelling is shut in and tension rises rapidly causing extreme severity of the pain. The pain may be so great that the child will scream with pain if his limb is moved, or even if the bed is accidentally knocked.

If treatment is not given promptly, the tension of the inflammation will cut off the blood supply of the affected portion of bone and it will die. Thus an infected sequestrum will form. The pus lifts up the periosteum and then, after a few days, bursts through it. Tension has been relieved and pain diminishes. The pus next finds its way to the surface, a subcutaneous abscess forms, and then this in turn bursts through the skin. A sinus has now formed and this will continue to discharge for months or years, owing to the presence of the dead sequestrum of bone. This stage is known as *chronic osteomyelitis* The body has however, become adapted to the organisms, and the patient has few symptoms Bacteria may pass up the sinus and cause a secondary infection with new organisms or the balance between the old organisms and the resistance of the body may be upset so that the infection flares up again.

Meanwhile, the living bone cells which have been lifted up with the periosteum, form new bone round the sequestrum. The case of new bone round a sequestrum is known as an *involucrum*.

There is one early complication that is sometimes misleading As a part of the inflammation there is swelling of the surrounding tissue and this will include an effusion of synovial fluid into the neighbouring joint. It is sometimes difficult to tell whether the patient is suffering from an acute septic arthritis of the joint or an acute osteomyelitis close to the joint. The correct answer may be found quite easily by aspirating the joint. If it contains clear sterile fluid the cause is infection in near by bone but if it contains pus and organisms, infection of the joint itself is the cause of the trouble.

Treatment

If treatment is begun early and enough penicillin is given, the great majority of acute cases can be cured without the formation of pus or death of the bone.

In a very acute early case morphine will probably be required for the relief of pain and the limb must be splinted for the femur or upper tibia the best splint to use will be a Thomas splint with traction as for fractures of the femur *If the neighbouring joint is* obviously swollen it is aspirated to make sure that the infection is in the bone rather than in the joint. Soluble penicillin is then given in large doses. Whatever the age of the patient,

200 000 to 400,000 units should be given at once, and this should be followed by 100 000 to 200,000 units four hourly

If the temperature shows no sign of settling at the end of two to three days, or if pain is persistent, then either pus is present under the periosteum and is causing tense stretching of the periosteum, or else the organisms are insensitive to penicillin. The cause is usually a collection of pus and this should be released. In many cases it can be aspirated by using a very wide-bore needle but in other cases it is preferable to incise the abscess In this case the skin wound may be sutured again immediately the pus has been released there has been no infection of the soft tissues, and as the patient is receiving heavy doses of penicillin no more pus may form. Suture of the wound in this way will lead to more rapid healing of the wound and will prevent secondary infection.

As soon as the temperature begins to fall and the general condition improves it is obvious that the infection is coming under control The large doses of soluble penicillin should be continued until control is obviously well established. Then they can be replaced by daily injections of 200 000 to 400 000 units of procaine penicillin. The procaine penicillin must be continued until the temperature has been absolutely normal for four to five days. The patient is then kept in bed for a further month to allow the body to destroy the remaining organisms in the bone and to allow the damaged bone to strengthen, as early weight-bearing has sometimes caused fractures of the weakened bone. It is unnecessary and uneconomical to continue with penicillin treatment after the acute symptoms have been controlled.

If the patient does not come to hospital until three or four weeks after the onset, a sinus may already have formed. An X ray will show a section of the bone which is more dense than the rest and which has therefore lost its blood-supply and died. Any remaining infection and toxaemia should be treated with penicillin, and the limb X rayed at monthly intervals In time, an X ray will show that the portion of dead bone has become loose (that is, it has sequestrated) and is surrounded with an involucrum of new bone. When the involucrum is strong enough to support the limb this is the time to operate and remove the dead bone and it is as well to give prophylactic penicillin injections before, and for a few days after, the operation.

During the patient's illness he must be encouraged to exercise all unsplinted joints. Further exercises will be required after recovery to loosen stiff joints and strengthen muscles.

Chronic osteomyelitis

Sometimes patients are not seen until many months or years after the onset. In some cases this is because of ignorance or fear of hospitals, and in other cases it is because the organisms were of low virulence and the original disease was not very acute.

In the first case one will expect to find a chronic discharging sinus, and the X ray will show a sequestrum surrounded by a thick, hard layer of new bone. Treatment is by operation. The involucrum is removed from one side of the bone and the sequestrum is removed; the muscles are then brought over the hole in the bone, the skin closed, and the patient given moderate doses of penicillin. If the skin cannot be closed without tension, the wound is packed with soft paraffin gauze as in an infected compound fracture, and covered either by a bandage or with plaster of Paris. The dressings are changed at long intervals of one to four weeks.

If the virulence of the organism was low, local destruction may have led to the formation of an abscess within the bone, which will be surrounded by fibroblasts and osteoblasts to form a wall of new fibrous tissue and bone around the abscess. In this case the pus may never burst out to the periosteum or to the soft tissues. The bacteria may all be killed and the infection *resolve, leaving a sterile abscess*, but sometimes the bacteria persist and chronic localized infection results. This is known as a *Brodie's abscess*. The patient has a chronic, aching pain in the bone and the abscess may be shown on X ray examination.

The walls of a Brodie's abscess are so thick and bloodless that penicillin cannot get through from the blood stream. The patient must be treated by an operation to open and drain the abscess. This treatment is followed by large doses of penicillin (*1 million units a day for an average case*). The penicillin must be given in large doses, as the remaining bacteria are hidden away in the fibrous walls where the circulation is poor, but after operation there will be an increased blood-supply to the part and it should be possible to destroy those that remain.

JOINTS

Inflammation of a joint is called *arthritis* and there are many possible causes of this In most cases diagnosis is fairly easy but in some cases considerable investigation may be necessary to find the cause. If in doubt, the best treatment is often to prescribe rest, usually in plaster of Paris for three or four weeks and then the joint can be re-examined and fresh X ray pictures can be taken

Traumatic synovitis or arthritis

This is not an inflammation due to infection but is due to injury (see Chapter 7) Fluid aspirated from the joint may be clear blood stained or consist of pure blood but it is sterile, and the slight temperature which always follows injury soon settles down. As with all joint injuries the surrounding muscles must be carefully strengthened, so that the joint is protected from future twists and strains and the development of recurrent or chronic synovitis.

Pyogenic or septic arthritis

Pyogenic arthritis may result from a compound joint injury or may arise from a blood borne infection in the same manner as acute osteomyelitis.

The patient is in severe pain which is maximal in the region of the joint. There is swelling of the joint and surrounding soft tissues and if the joint is near the surface, fluctuation may be obtained. The patient feels great pain if the joint is moved and he tries to keep it still in the most comfortable position. Unfortunately this position is not always the position of function that is the position in which the joint will be of most use to the patient if it should become stiff The position of function of each joint will be described in Part Two

The organisms responsible for the infection are usually the pyogenic cocci, but gonococcal and pneumococcal arthritis are also found.

Gonococcal arthritis is usually confined to the synovial membrane of a joint, but it is a very chronic disease and may give rise to considerable stiffness. The fluid which is obtained by aspiration is usually clear but a little pus may be seen and

microscopic examination will show some pus-cells Organisms are rarely found, as they are multiplying within the synovial membrane and do not enter the synovial fluid. Gonococcal arthritis should be suspected in any case of chronic arthritis for which no other cause can be found, even though the patient denies infection.

Penicillin does not always cure gonococcal arthritis, and the patient may have to be treated by prolonged rest. In these cases an intravenous injection of T.A.B is sometimes helpful. The T.A.B is given directly into the blood-stream in a sufficiently high dose to cause a sharp body reaction with a rise in temperature, usually with a rigor This body reaction helps the patient to overcome the infection The T.A B is given in increasing doses twice a week, starting with 1 minim diluted in 5 c.c. of sterile water and this dose is doubled every time unless the previous reaction was very severe. In that case the previous dose or one slightly smaller, is given. Five injections are usually sufficient.

Meanwhile, the joint is kept at complete rest and all other joints are exercised.

Infection by other pyogenic organisms usually gives rise to a *suppurative arthritis* If this is mild, only the synovial membrane is affected and treatment should lead to a good recovery

In an acute case the surrounding bones should be examined to exclude osteomyelitis The joint is aspirated and then put at rest traction is used for the knee or hip-joints, and splints of wood, metal or plaster of Paris are applied to other joints Penicillin is given in the same large doses as for acute osteomyelitis and if necessary morphine is given to relieve pain.

As the fluid and pus re-form in the joint, further aspirations will be necessary and great care must be taken each time to prevent secondary infection from getting in at the time of aspiration The use of a two-way stop-cock makes unnecessary the removal of the syringe from the needle each time the syringe has to be emptied. Otherwise, every time the syringe is taken off or put back, the needle will be handled and there is then a risk that other organisms will be either sucked or injected into the joint.

A slow response to treatment, or persistent pain on movement after infection has been controlled suggests that the infection was severe enough to attack the joint cartilage and possibly the underlying bone. Adhesions will then form, giving rise to a fibrous

and possibly a bony ankylosis. It is because of the risk of this permanent stiffness that the limb must be treated in the position of function.

Mild adhesions may be overcome by active exercise stronger ones may be broken down by a manipulation of the joint, usually under an anaesthetic, but really severe adhesions or bony ankylosis will lead to permanent stiffness.

Manipulations for adhesions should never be done until all infection is completely controlled and the patient has strengthened his muscles by exercises and obtained as much movement as he can by himself The manipulation consists of one or two short sharp jerks. Repeated movements are harmful as they will cause a traumatic arthritis, and more adhesions will form.

If bony ankylosis has occurred in good position, nothing further should be done. If it is in bad position the bone may be fractured with a chisel-like instrument called an osteotome, and the position corrected The bone is then treated as a closed fracture. The open division of a bone is known as an osteotomy

If permanent stiffness is due to dense fibrous adhesions there may be slight but painful movement with recurrent swelling of the joint. If these adhesions are too dense to be broken down by manipulation, and if pain is severe, the patient will probably be more comfortable with a completely stiff joint which causes no pain. In order to obtain this the fibrous ankylosis must be converted to a bony ankylosis. This is done by excision of the joint and compression of the bone-ends together until they unite. This operation is called an arthrodesis.

Rheumatoid arthritis and *tuberculous arthritis* are dealt with in Chapter 10 and *osteoarthritis* which is a degenerative disease, in Chapter 12

CENTRAL NERVOUS SYSTEM

Anterior poliomyelitis

Poliomyelitis used to be called infantile paralysis but this name is no longer used as the virus also attacks adults, although less frequently than children, and paralysis does not always result from infection.

It is an acute infectious disease caused by a virus which is usually spread by droplet infection during epidemics. The virus

can also be spread by infected water or on articles handled by infected people, as in the spread of typhoid fever This is because the virus is excreted in the faeces of infected persons. This method of spread is the probable route by which the infection is conveyed from child to child in those countries where hygiene is poor and the disease is endemic.

In most tropical countries cases are always occurring amongst children even when there is no epidemic present, because the standard of hygiene is generally low, epidemics are rare because a very high proportion of the population has been immunized in infancy by viruses with a low virulence.

When an epidemic of high virulence does occur it affects chiefly the unprotected infants. Such an epidemic does not spread widely through the country

Some patients develop a feverish cold which lasts for two to three days, and they then recover The unfortunate patients are those few whose resistance is very poor for in these cases the virus multiplies and eventually invades the anterior horn cells in the spinal cord or the base of the brain, and paralysis develops. It has been proved that paralysis is much more likely to occur if the patient takes strenuous exercise during the time of the preliminary feverish cold, or if he receives either an injury such as a surgical operation or an injection, for example of quinine or penicillin

For this reason, no tonsillectomy or other non urgent operations should be done during an epidemic anyone with a feverish cold should avoid strenuous exercise and no injections should be given for fever if there is any chance that the fever may be due to poliomyelitis

When the virus has invaded the anterior horn cells and caused paralysis some of the paralysis will be due to the death of nerve-cells, and these will never be able to recover but a large part of the muscle weakness is due to pressure on the nerve-cells by inflammatory oedema, and these cells will have a good chance of recovering later This means that there will always be hope that power will return to some or all of the paralysed muscles as long as they are not overstretched by lack of splinting A badly stretched muscle has a poor chance of recovery and it will have none at all if the opposing muscles have been allowed to act strongly and cause deformities

The most serious cases are those in which cells at the base of

the brain have been affected, as then there may be paralysis of respiration and of swallowing

Treatment

During the first three weeks after infection the patient should be nursed in an infectious diseases hospital, but if there is any paralysis present a surgeon should see the patient at a very early stage. He will be able to advise about splinting, and it is he who will have to look after the patient later and treat any permanent paralysis or deformities that may occur

For the first six weeks the patient should be treated by absolute rest. Splints should be applied to wrists and ankles if they are affected, so as to prevent over-stretching of muscles and the knees should be slightly bent over a pillow Stiffness of joints must also be prevented. This is done by bending every paralysed joint through the *full* range of its possible movement once a day This is done for the patient, who should make only slight effort himself. If respiration is paralysed, artificial respiration will be required in a special apparatus known as a *respirator*

After six weeks the inflammation in the spinal cord has subsided and active exercises can begin. The patient is taught how to use his muscles again, but he must not be allowed to overtire them. Weak muscles may have to be protected by splints. In the lower limb this may be done by giving the patient boots and walking-calipers. Muscle exercise is very much easier if the effect of gravity can be removed as in swimming which the patient may be taught if necessary Swimming must be carefully supervised so that the physiotherapist can see that the proper muscles are being used and that the weak ones are being encouraged without being over strained.

Progress will be quite rapid in the first three months, but after that it begins to slow down and by the end of a year very little further recovery can be expected. Muscles which have recovered can still be exercised to make them stronger but those which are very weak or totally paralysed will require some other form of treatment.

In this chronic stage a great deal can be done to help the patient. Strong muscles may be pulling the foot into a deformed position, and their tendons may be *transplanted* so that they pull in a better direction. Calipers may be necessary for many years

or for life, but often when the child has reached the age of twelve or fourteen, weak joints may be arthrodesed and the calipers discarded. Arthrodesis is not usually done at a younger age than this, because the bones are still growing and growth might be upset.

Finally, in a neglected case deformities may be present these may have to be corrected before calipers can be fitted, or tendons transplanted, or arthrodesis can be performed.

Tetanus

Tetanus is not strictly an infection of the central nervous system, but the disease may be considered here conveniently as the principal effects of the disease are due *to irritation of the motor* cells of the nervous system by the tetanus toxin.

Tetanus bacilli thrive in the lower alimentary tracts of animals, and possibly man. When they are dried they are converted into spores and can live for a long time in this state. They can even resist boiling for five or ten minutes.

The spores or the live bacilli may get into wounds which have been *in contact with earth soiled with animal droppings* and they may even get into operation wounds performed near the perineum of patients who have not been properly cleaned and prepared for operation. This was probably the cause of the series of cases of post-operative tetanus in Dar es Salaam in 1952 and 1953

Tetanus bacilli, like the bacilli which cause gas gangrene of muscle, can only *grow and multiply if oxygen is kept away from* them. They are therefore said to be anaerobic organisms They cannot thrive in a clean-cut wound, or in an operation wound where the operation has been done cleanly and gently If a wound has been caused by a dirty weapon or if there is much bruising of the tissue either by a blow or at the time of an operation there will be a chance for the bacilli to survive and grow

Gas gangrene is extremely rare it is hardly ever seen except after the cruelly lacerated wounds of warfare, especially if the battle has taken place in wet, muddy fields Tetanus is much more common than gas gangrene, but it also is rarely seen if the patient receives early surgical attention, and if all bruised and damaged tissue is excised

Once the organisms have developed in a dirty wound they produce an extremely powerful toxin This toxin enters the

blood stream and then becomes attached to, or 'fixed' by, the cells of the central nervous system The patient becomes apprehensive, he feels a peculiar tenseness in his muscles, and then these go into spasm. At first the spasms and tightness may only appear round the muscles of the jaw, but as more toxin is fixed by the nerve-cells the spasms become worse and spread to the limbs and trunk muscles. The spasm may be sufficiently severe to cause an arching of the back so that the patient lies on the bed supported only on his head and his heels This position is called opisthotonos. Between attacks the muscles never really relax completely and as the disease becomes worse, the attacks become more and more frequent until death may occur

Occasionally treatment may not be able to abolish the spasms for perhaps several weeks in these cases fractures of the spine have been known to occur together with bony deformities of the chest in young persons.

Prevention

Injection of tetanus toxin can cause an active immunity so that the person is protected against tetanus for many years.

Very few people have, however been protected in this way and other measures must be taken. Post-operative tetanus is best prevented by very careful pre-operative preparation of the patient, proper sterilization of all instruments, theatre linen and ligature material and by gentleness during operations.

Tetanus from wounds is best prevented by a very careful excision of all bruised and damaged tissue from a wound. If it is known that the wound was caused by an instrument that may have been contaminated with tetanus spores or if there is any possibility that dead tissue has been left in the wound, the patient should be given an injection of 4,500 units of anti-tetanus serum. This will give him a passive immunity which will last for at least a week. If the wound was definitely dirty it is wise to repeat the injection at the end of a week. Dirty septic, neglected burns are included amongst the wounds which may harbour tetanus spores.

Treatment

The aims of treatment are

(1) The destruction of the bacilli to prevent more toxin from being formed.

(2) The destruction of toxin which is already in the circulation—there is no method of destroying the toxin which is already fixed by the nerve-cells The toxin is a chemical substance and the fixed toxin will slowly disappear from the body if the patient can be kept alive long enough.

(3) The control of spasms

(4) The provision of rest and sleep for the patient.

(5) The giving of adequate nourishment.

Destruction of bacilli The wound must be opened if stitches have been inserted, and all loose sloughs must be removed, but care must be taken not to cut through the barrier of defence that the body has made during the previous few days, as this will allow the release of more toxin into the circulation. If a limb or a finger is badly damaged, then an amputation through healthy tissue will be of value. Penicillin should also be given in very high doses, giving up to two or three million units a day It is not absolutely certain that the tetanus bacillus is sensitive to penicillin, but it is believed that it is sensitive to very high doses

Destruction of circulating toxin This is achieved by the slow injection of 50 000 units of antitoxin intravenously and the injection of a further 50 000 units intramuscularly The antitoxin will remain in the circulation for about a week and will destroy any fresh toxin coming from the wound Even if the spasms have been controlled the injections should be repeated at the end of the week if the case has been severe.

Control of spasms Ten c.c. of paraldehyde is quite effective if sterilized and injected intramuscularly the injection will have to be repeated every four or six hours Neither morphine nor the barbiturate drugs are as good, but some of the new muscle-relaxant drugs are very effective. They have to be used with great care because of the risk of causing paralysis of respiration

Provision of rest and sleep Control of spasms will provide rest and may allow the patient to sleep but he may also be suffering from pain in the tired muscles, and in these cases morphine may be administered This must be given carefully as morphine given to an already drowsy patient may depress respiration severely and he may develop pneumonia.

Provision of nourishment Any movement, such as knocking the bed adjusting the bed-clothes or feeding the patient, may start off a new spasm Food should therefore be given shortly after the injection of paraldehyde or muscle relaxants when the

spasms are most under control. In severe cases a thin gastric tube such as a Ryle's tube should be passed by the mouth or down the nose into the stomach and left there, fluids can then be given down the tube with no disturbance to the patient at all. Dehydration must be prevented by the giving of adequate fluid.

By careful attention to all these details, recovery should be achieved in the majority of cases.

CHAPTER 10

CHRONIC INFECTION

WHEN the body is unable to overcome an acute infection quickly the infection becomes chronic. This condition may also be described as a persistent acute infection. *This most commonly* happens when there is some portion of dead tissue present in the infected area, as in a chronic osteomyelitis or when there has been a reduction of the blood supply to the part because of scar tissue, as in a chronic tropical ulcer

The treatment of a persistent acute infection is *to remove* all sloughs and sequestra or to excise the scar tissue that prevents healing If antibiotics or sulphonamides have been used previously, the persistence may be due to resistance to these drugs by the organisms In such a case the organisms should be cultured in the laboratory and the drug changed to one to which the organisms are found to be sensitive.

Genuinely chronic infections are principally medical diseases, but certain aspects or complications of them may be treated by surgical measures.

YAWS AND SYPHILIS

These are infections caused by spirochaetes There is a stage of primary infection with the formation of a *local* primary sore In untreated cases this is followed by the second stage, of general infection of the whole body the outbreak of skin rashes infection of mucous membranes, and sometimes of the meninges and other organs

The third stage appears months or years later and is characterized by chronic infection of the blood vessels bones and skin—not as a general infection all over the body but in small isolated foci The lesion is known as a *gumma* and the infection in bone is also known as a syphilitic or a yaws *osteitis*

It is the third stage that is of interest to the surgeon for the gummata and the osteitis may be confused with tumours or

other conditions and he must always be alert to the possibility when examining a tumour that a spirochaetal infection may be present.

The most important point to remember is that the infection of the arterioles and capillaries leads to a narrowing of these vessels and a reduction in the blood-supply to the gumma. Gummata in the skin break down and ulcerate and are very slow to heal there is no obvious pyogenic infection unless this has occurred subsequently and the base is covered by a pale, avascular slough. The presence of scars from previous gummata or secondary yaws may help in the suggestion of the diagnosis These scars are very thin and circular they have an irregular edge and are usually more pigmented than the surrounding skin.

In bone, the reduced blood supply is shown by an extreme denseness of the affected area on X-ray examination. The patient has sharp stabbing pains in the bone especially at night, and when he is examined thickening and tenderness are found, suggestive of a chronic osteomyelitis There is, however very little bone destruction, rarely any pus formation and always a considerable increase in new, hard bone formation

The diagnosis is confirmed by taking the blood for Wassermann or Kahn tests, but clinical judgement is always more important than laboratory tests, and it must be remembered that a patient with a positive Kahn test may also be suffering from some other disease.

Yaws responds rapidly to appropriate doses of neoarsphenamine and bismuth given once a week for four to five weeks Syphilitic infections respond to the same treatment, but the course has to be extended for at least ten weeks.

TUBERCULOSIS

Tuberculosis, like yaws and syphilis, starts as a primary infection in this case the primary is usually in the lungs, the mucous membrane of the throat or the intestines.

The primary infection is followed by a general invasion of the body with a low fever an increased lymphocyte count in the blood-stream, a raised erythrocyte sedimentation rate and a general deterioration in the health of the patient.

If the second stage does not cause the death of the patient from miliary tuberculosis or toxaemia, a chronic infection develops

and, like the gummata of syphilis, lesions may appear in distan parts of the body

Again it is the chronic stage that interests the surgeon whether the lesion be a chronic pulmonary infection with a lung abscess enlarged glands in the neck, tuberculosis of bone or joint, chronic bowel infection or infection of the kidney or epididymis

Each of these lesions will be dealt with as each part of the body is discussed, but we shall discuss here the general pathology and the general lines of treatment.

Pathology

The tubercle bacillus *secretes a toxin which has a very destructive effect* on neighbouring tissues The resulting focus of necrosis is surrounded by lymphocytes and large cells, each containing many nuclei called giant cells There are very few polymorphonuclear leucocytes, and true pus is not formed. All the signs of local inflammation are very much milder than with a pyogenic infection and, if fluctuation does occur due to liquefaction of the dead tissue the result is known as a *cold abscess*

A tuberculous lesion rapidly becomes very much worse if secondary infection is allowed to enter and so a cold abscess should never be incised and the wound left open but should be aspirated. *Aspiration may be followed by tuberculous infection* of the needle track and the formation of a sinus, for this reason the needle should be inserted through the healthy skin at one side of the abscess and not in a straight, short line through skin which is about to break down

The tuberculous toxin not only destroys the surrounding tissues, but it also inhibits new tissue from growing in both by its action on the cells and by the obliteration of small blood vessels The result is that healing is very slow Once a focus has developed, it may take one to two years for healing to occur This is particularly noticeable in bone and joint disease.

The X ray differences between pyogenic osteomyelitis spirochaetal osteitis and tuberculous infection are very marked.

In *pyogenic osteomyelitis* there is bone destruction and the rapid formation of new bone to repair the damage.

In *spirochaetal infection* there is a dense formation of new bone with very little destruction of bone.

In *tuberculous infection* there is local destruction, surrounded by a wide area of decalcification and, for the first few months, no sign of bone repair

Treatment

The ideal treatment of a local focus of tuberculosis is surgical excision. For anatomical reasons this cannot always be carried out (for example if the disease is affecting one or two vertebral bodies in the spine) Even when it can be carried out, it should never be done until the patient's general resistance has been improved. If any operation is done too soon, there may be a further spread of infection through the body or the wound may fail to heal Then secondary infection and death from toxaemia may occur

Active tuberculosis has a profound effect on the whole body which is shown by the patient's general condition by a persistent low temperature and by a raised erythrocyte sedimentation rate. All three of these must be watched during treatment, and surgery withheld, until it is obvious that the general effects of the disease are well under control.

The first principle in treatment is rest. Rest must be as complete as possible, it must be uninterrupted, and it must be prolonged.

Rest to the whole body is obtained by confining the patient to bed rest to the local focus of infection is also enforced if this is at all possible. Affected limbs may be splinted and lungs may be rested by collapsing them by means of an artificial pneumothorax or pneumo-peritoneum, but local rest cannot so easily be applied to the intestine or genito-urinary system.

Combined with rest are the general supporting measures of a good, nourishing diet plenty of fresh air the correction of anaemia and the elimination of any obvious infection in the form of intestinal parasites or bilharziasis.

Finally the patient is also given drugs. There is no antibiotic which will cure tuberculosis but there are three drugs which do have a very good effect if they are given for long enough. Unfortunately the tubercle bacilli are able to develop a resistance to all three within the course of a few months but this resistance takes far longer to develop if the patient is given two of the drugs simultaneously

The drugs used are

Streptomycin This is an antibiotic and the adult dose is 1 gram per day

Para amino-salicylic acid (P.A S) The dose is 20 grams per day

Isonicotinic acid hydrazide (isoniazid) This is given in dosages of 300–500 milligrammes a day

Fortunately the African appears to be comparatively resistant to tuberculosis, as a rule, and good results have been obtained, in surgical' tuberculosis from 1 gram of streptomycin given twice a week together with 150 milligrammes of isoniazid daily

BRUCELLOSIS AND TYPHOID FEVER

The organisms of undulant and enteric fevers occasionally cause bone abscesses, especially in the spine, and the blood should be tested for their antibodies in obscure cases of bone destruction These conditions respond well to modern medical treatment.

Enteric organisms may also persist in the gall bladder, making the patient a chronic carrier of the disease. If it is proved that the gall bladder is infected a cure may be obtained by removing the organ (cholecystectomy)

RHEUMATOID ARTHRITIS

This is a form of arthritis rarely found in Africa. The treatment is medical, but surgical treatment is sometimes required for the correction of deformities

LEPROSY

The treatment of leprosy is also medical but again surgery may be able to assist in the prevention of deformities, or their correction once the disease is no longer active Pain may often be relieved and subsequent deformity prevented by incising the affected nerves to release tension.

The disease is liable to attack the ulnar and median nerves and in cases with permanent paralysis considerable improvement in function can be obtained by the transplantation of tendons Some patients also develop a foot drop from paralysis of the peroneal nerve, and in these cases an arthrodesis below the ankle can be performed.

Tendon transplants can only be carried out if the finger joints are mobile and free from ulceration Many of the deformities of leprosy are due to burns and infections of the fingers that are neglected because the patient feels no pain All leper patients should be taught to avoid burns and injuries to the fingers and to seek immediate treatment if they occur

FILARIASIS

Filariasis causes damage to the lymph drainage of the limbs or scrotum by invasion of the lymphatic vessels and glands with the result that scar tissue is formed and the valves in the lymph-vessels are destroyed, so that lymph fluid cannot be pumped up against gravity

In the early stages the patient suffers repeated attacks of filarial fever which is accompanied by local heat and swelling of the limb or scrotum. This can be controlled in each attack by the application of local soothing dressings and elevation of the part, and it may be possible to destroy a large number of the filariae by giving the patient tablets of Hetrazan or Banocide. The dose is ten tablets a day for one week.

Sometimes a *lymph scrotum* occurs. There is very little thickening of the skin, but there is a periodic leakage of lymph through the skin to the surface

After repeated attacks the skin becomes permanently thickened and oedematous and there is a firm oedema of the subcutaneous tissue, which does not pit on pressure. This is the condition known as *elephantiasis*

When the stage of lymph scrotum or of elephantiasis has been reached surgical operations are the only form of relief available. In the scrotum, the whole of the affected tissue may be excised. In the limbs some improvement may be obtained by removing all the affected subcutaneous tissue and either replacing the skin-flaps or applying skin-grafts but in really severe cases the only possible treatment is amputation of the limb

AMOEBIASIS

Chronic amoebic dysentery sometimes causes a granuloma, or tumour of infected tissue, localized to the lower bowel or the region of the caecum. The chief surgical interest in this event

is to remember the possibility of an amoebic granuloma when a tumour is found in these parts, as otherwise the patient may be submitted to a very large operation for the removal of a suspected malignant tumour

Amoebiasis is also the cause of one form of liver abscess

BILHARZIASIS

Chronic urinary bilharziasis may affect the lower end of the ureters and cause extreme narrowing of the lumen. There is then back pressure on the kidneys, which we shall discuss with other causes of urinary obstruction. Renal calculi may also form in the distended kidney pelves Cases of stricture of the ureter may be treated by division of the ureter and implanting the dilated portion into a fresh part of the bladder

Chronic irritation of the bladder wall by bilharzial infection may cause a malignant change and carcinoma of the bladder develops It is unfortunate that most of these patients are seen when the disease is already too advanced for treatment.

MYCETOMA (MADURA FOOT)

This is a chronic infection caused by a fungus. The fungus enters the foot, probably through some crack or injury and grows and multiplies in the tissues of the foot If untreated it will gradually destroy the soft tissues and bone.

The patient has a large, swollen foot with multiple discharging *sinuses*. In a typical case hard black granules of fungus can be seen coming out of the sinuses with the purulent, watery discharge.

In severe cases the only available treatment is amputation but in moderately severe cases very good results have been obtained by the use of streptomycin together with local excision As much of the infected tissue as possible is cut away the wound is left open and packed with zinc iodoform paraffin paste The patient is then given one gram of streptomycin daily for three or four weeks. Twenty grains of potassium iodide may also be given three times a day This has the very good effect of improving the blood supply in chronic infections and so assisting the body fluids and the streptomycin to get close to the remaining infection.

ACTINOMYCOSIS

Actinomycosis is another fungus infection. It is not very common and occurs most frequently in relation to the alimentary tract. Thus it may be seen as a chronic inflammation, with multiple sinuses, in the region of the parotid gland or the caecum. Granules may be seen exuding from the sinuses, and in this case they are a yellow colour

This fungus is sensitive to very high doses of penicillin, and cures have been reported after the administration of one million units daily for three weeks, combined with potassium iodide.

HYDATID CYSTS

A hydatid cyst is the result of infection by the eggs of the tape worm of the dog called the echinococcus The cysts most commonly form in the liver but they may also occur in the lungs and even in bone. Liver cysts may burst and infect the peritoneal cavity forming fresh cysts there, and they may also spread in the blood stream to other parts of the body The author has seen one case with a large cyst in the liver a second in the pelvis and a third in the lower end of the radius.

The cysts have two layers. The inner is the living, invading organism it is only a few cells thick and acts as the lining to a cyst full of fluid. On the inner wall daughter cysts may be found. The outer layer is a fibrous wall formed by the body in its attempt to prevent the cyst from expanding

Treatment is by excision If this proves to be too difficult the cyst may be aspirated and then injected with formalin (4 per cent.) in order to destroy the living cyst cells.

CHAPTER 11

TUMOURS

BENIGN TUMOURS

BENIGN tumours are composed of a mass of normal tissue cells Their exact origin is uncertain, but it is probable that they usually arise as one form of congenital abnormality

The normal life of a body cell is very short. For example, red blood cells only live for about three weeks, and then they are replaced by new cells from the bone marrow In the same way the surface layers of the epithelium are constantly dying and being replaced by new cells from the deep layers of the epithelium. This may be seen after the removal of a plaster cast, when the skin will be found to be covered with a layer of dead epithelial cells.

The deeper skin cells are more primitive than the surface cells, that is they retain the power of dividing to form more mature cells in the same way the body contains primitive fat, muscle bone and other cells You can imagine that a lump will be formed if too many primitive cells have been deposited in one place.

Some tissues can also multiply more rapidly if they are stimulated by hormones, and this is the cause of the benign enlargement of the prostate which tends to occur in men over the age of fifty

The names of most tumours end with the syllables oma just as most acute infections have names which end with the syllables itis The plural of a word ending in -oma ends with the syllables -omata

In the case of benign tumours the first syllables usually describe the tissues from which the tumour arises, which makes description fairly easy The main varieties of benign tumour are as follows

Papilloma A wart like tumour of skin or mucous membrane This may be found on any part of the skin and a papilloma of the bladder is not uncommon Repeated irritation may stimulate the papilloma to become malignant.

Sebaceous and dermoid cysts are also varieties of benign tumour of the skin. The sebaceous cyst arises from a blocked sweat gland the cyst lies *within* the skin and there is a collection of skin secretion known as *sebum* within it. The tumour will disappear rapidly after incision but will soon fill up again with fresh sebum. The whole cyst should be removed surgically for a complete cure to result.

Dermoid cysts arise *underneath* the skin and are due to the presence of a small ball of skin in the subcutaneous tissue. The dermoid also secretes sebum which accumulates inside the cyst, and it may also have hairs growing within it. Both varieties of cyst are more common in the region of the head and neck than elsewhere.

A dermoid cyst is also treated by excision The excision of either cyst may be done by cutting all round it and removing it, but a simpler method is to open the cyst, squeeze out the sebum and then grasp the inside lining layer of skin with artery forceps the cyst may then be pulled out, like the lining of a pocket, inside out.

Keloid A keloid is caused by an overgrowth of scar tissue in skin following an injury It is very common in African races The best method of treatment is excision and immediate skin grafting Excision and suturing with tension is liable to be followed by a recurrence.

Lipoma. This is the most common variety of subcutaneous tissue tumour It is made up of an accumulation of fat-cells. As in the case of most other simple tumours, the chief reason for treatment is its unsightly appearance. It is fairly easily dissected out from the surrounding tissue. The tumour varies in size, it is fairly soft and is divided up into lobules by strands of fibrous tissue which connect it to the skin.

A *fibroma* is a tumour of fibrous tissue. This is usually comparatively small and is very much harder than a lipoma. Removal if the patient wishes it, is quite simple.

Myoma. Simple tumours of ordinary muscle are comparatively rare. The most common site is in the uterus where a *fibro-myoma* causes the very common *fibroids* of the uterus.

Angioma. This is a simple tumour of blood- or lymph vessels. The *haemangioma* is not uncommon and, if it lies in the skin, it causes the purple stains known as a birth-mark If it is very unsightly it may be removed, but the purple mark is much less

unsightly on a pigmented African skin than on a European's skin.

A *lymphangioma* is uncommon, but it is sometimes found as a very large tumour on the neck of newly born infants It is then known as a *cystic hygroma*

Removal of very large angiomata may be difficult. Where these occur it may be possible to reduce their size by the in jection of boiling water or drugs which cause coagulation of blood and lymph. The *tumour is thereby replaced by scar* tissue.

Osteomata and *chondromata* are rare benign tumours of bone and cartilage, respectively They may be removed if they are unsightly or if they are pressing on other important structures.

Adenomata are tumours of glandular tissue. They may be found in the breast, thyroid ovary, prostate, bowel and other glandular tissue. Removal is only indicated if they grow to a large size, are unsightly, or are causing symptoms from pressure. An important example of the latter is retention of urine resulting from an adenoma of the prostate.

In some cases an adenoma is removed whether it is causing trouble or not. This is because it is just possible that the tumour which has been found may be malignant, not benign, and therefore it is a wise precaution to remove the tumour and examine it.

Teratomata. These are rare tumours composed of very primi tive cells coming from all possible tissues of the body, that is they may contain skin, bone, cartilage and glandular tissue. They may be found in the testicle or ovary or sometimes, in the posterior wall of the abdominal cavity The cells are so primitive and have such a great power of growth that they may very easily turn malignant.

A *neuroma is a benign tumour of nerves* and an *odontoma* a benign tumour of teeth a *meningioma* arises from the meninges there are also various varieties of *brain tumour* None of these are very common

MALIGNANT TUMOURS

Malignant tumours are very different from benign tumours In malignant tumours the cells have acquired the power of inde pendent growth and are under *no control by the body* The

body tries to defend itself from these enemies which have arisen in its own tissue, in the same way that it defends itself against injury and infection, by trying to build a wall or barrier of fibrous tissue around the tumour

If the malignant cells are relatively mature, the growth will be slow and the fibrous wall may be quite effective, but if the malignant cells are very primitive they will rapidly grow through any fibrous tissue barrier and invade the surrounding tissue

If they arise from the skin or invade the skin from below, the skin may eventually break down and a malignant ulcer will form. If they invade lymphatics or blood vessels, cells may break off and be conveyed to the nearest lymph glands or to distant bones or other tissues The transported cells are able to grow and multiply in their new resting place, and a secondary tumour is formed. Secondary tumours are known as *metastases* A *metastasis* occurring in bone causes a weakening of the bone, and a pathological fracture may occur

Once spread has occurred beyond the nearest lymph glands curative treatment becomes impossible. All that can be done is to relieve the patient's symptoms of pain or obstruction and await his death within a few months or a year or two

Treatment, if it is to be effective, must be carried out before lymph gland invasion has occurred this is the reason why very serious attention should be paid right from the very start, to any patient who develops a lump in, or sign of obstruction of any organ

radium burns or destruction of important tissues. The uses of radium or deep X rays are therefore very limited.

In the great majority of cases the cause of malignant disease cannot be traced, and so prevention is difficult One must make every endeavour to detect the first sign and start treatment at once

Other cases are definitely the result of repeated irritation, the attempts of the body to heal a chronic ulcer or the excessive stimulation of a gland by hormones Prevention of some malig nant tumours can be achieved by removing the cause of chronic irritation and in tropical ulcers ensuring that healing occurs with a good covering of skin. This is where skin grafting for ulcers assumes importance

Malignant tumours like benign tumours, have names which end in oma *Cancer* is a general word used for all malignant tumours and cancers may be divided readily into *carcinomata* and *sarcomata*.

A *carcinoma* is a malignant tumour of skin or glandular tissue. The latter is also called an *adeno-carcinoma*. A carcinoma of the skin is known as an *epithelioma* one special variety found almost entirely on the face, is known as a *rodent ulcer* and another most often found round the feet and ankles is a *melanoma* This is a very malignant tumour usually pigmented a very black colour

Common varieties of carcinoma are those of the breast, uterus, bladder and cervix and the epithelioma of skin.

A *sarcoma* is a malignant tumour of connective tissue and it is usually described by adding in front, the name of the tissue from which the tumour arises For example lipo-sarcoma chondro-sarcoma, myo-sarcoma, angio-sarcoma and osteogenic sarcoma.

Carcinomata spread most commonly by the lymph stream to glands before they spread to other parts of the body but sar comata have a greater tendency to invade blood vessels and therefore have a much more rapid and extensive spread

Differential diagnosis

Carcinomata rarely appear before the age of forty and are most common after the age of fifty A carcinoma of the liver or an epithelioma following a chronic ulcer however may appear at a much younger age.

Sarcomata frequently develop in quite young people.

The most characteristic sign that a tumour is malignant is the presence of local invasion which causes the tumour to be fixed to the surrounding tissue. Other signs are ulceration and the invasion of lymph glands or other distant tissues

A gumma lying over bone may be mistaken for a malignant tumour In these cases the Kahn or Wassermann tests are positive and the tumour rapidly subsides with anti-syphilitic treatment.

CHAPTER 12

DEGENERATIVE AND ENDOCRINE DISORDERS

DEGENERATION is the price which the body pays for long life. All the tissues of the body begin to age, right from the date of birth After the prime of physical life, in the early twenties the degenerative process becomes very much more rapid.

Some tissues degenerate more rapidly than others, and those which are soonest affected are the connective tissues Degeneration may be hastened by injury or disease and thus cause the patient trouble at a younger age than he would otherwise be affected.

The degenerated tissue tends to be replaced by fibrous tissue which we have already seen is the body's common method of repairing injuries and infections and protecting itself from the advance of malignant tumours The degenerated tissue frequently becomes calcified and may even be converted to bone if the tissue affected lies close to a bone or joint.

TENDONS

Advancing age causes a weakening of tendons, and a sudden strain on a degenerated tendon may cause its rupture. Rupture of the Achilles tendon, the patellar tendon and the supraspinatus tendon has already been discussed in Chapter 3

JOINTS

Degenerative disease of joints is known as *osteoarthritis* The termination itis suggests an infective cause for the disease, and for a long time this was thought to be so in the case of osteoarthritis The cause it is now known is not infection but degeneration, although the name has not been changed

In osteoarthritis the joint cartilage degenerates, exposing bare bone at the joint surface There is steadily increasing pain and stiffness and the body tries to protect the joint by strengthening the surrounding ligaments.

The ligaments thicken and calcify, and bone grows out into them from their attachments round the joint. These bony outgrowths are known as *osteophytes* The result of this development is an increase of stiffness and, as movement is decreased, the pain from the joint diminishes

Osteoarthritis may appear in quite young people, as a result of chronic strain on the joint. This may be due to poor reduction of a fracture, so that weight is not borne properly on the joint surfaces because they are tilted. It may also follow a fracture which enters a joint and then heals with an irregular joint surface. It can also follow a thrombosis of blood vessels close to a joint, so that the bone dies and the cartilage over it is deprived of its blood supply and degenerates (for example avascular necrosis occurring in the hip, after a fracture of the neck of the femur or a dislocation of the hip)

Treatment

In the early stages every effort must be made to keep the affected joint mobile. Pain may be relieved by heat, but it will be made worse by violent exercise. The patient should be given local heat to the joint by hot-water bottles, an infra red lamp or by short wave diathermy and then encouraged to exercise the joint gently

The hip is very commonly affected, and good improvement may be obtained by gradually increasing exercise. If the patient is encouraged to go for a five mile walk he will have such a severe reaction that he will have to rest in bed for days afterwards and, when he gets up again, the joint will be stiffer than ever But if he is encouraged to walk for half a mile every day for a week, then three-quarters of a mile every day for another week, and so on, he may get very much better

If pain is really severe, and cannot be relieved by these conservative means, the joint may have to be excised and arthrodesed Various complicated operations have also been devised to try to make new joints but this approach is very specialized.

INTERVERTEBRAL DISCS

It is now recognized that early degen
discs is a common cause of back ach

soft centre surrounded by a strong cover of fibrous tissue, arranged in the same manner as joint ligaments.

The inner nucleus of pulpy tissue is known as the *nucleus pulposus* It is capable of absorbing water just as salt or sugar can absorb water If this occurs there is an acute swelling of the disc and resulting back ache. The back ache is commonly known as *lumbago* It occurs most commonly between the ages of twenty and forty

The treatment is to give analgesics to relieve pain and advise complete rest in bed.

Repeated attacks of lumbago are followed by degeneration of the fibrous capsule and in later attacks some of the nucleus may squeeze out between the fibres into the spinal canal. This is the condition popularly known as a slipped disc' but is better known as a prolapsed disc. The protruding portion of the disc tissue may press on one of the peripheral nerves right at its root, and this is the chief cause of *sciatica*

Treatment is again by rest in bed and the giving of analgesics The piece of disc tissue slowly shrinks, and the pain and sciatica are usually relieved Complete rest in bed may be necessary for a month or six weeks Sometimes the case is treated by placing the back at rest in a plaster jacket.

Very occasionally rest does not result in recovery because the disc tissue which has slipped out is too large and continues to irritate the nerve after it has shrunk. In these cases an operation may be necessary to open the spinal canal and remove the disc tissue.

Repeated disc damage, or repeated strain of the back, may be followed by osteoarthritis of the spine. There is pain and stiffness of the back, and an X-ray will show the presence of osteophytes round the intervertebral joints This is most commonly seen after the age of forty and if it affects the neck joints it may be responsible for pressure on the nerve roots of the brachial plexus by the osteophytes.

Treatment of osteoarthritis of the spine is the same as for osteoarthritis elsewhere. If there is severe pain it may be relieved by rest this is followed by heat and steadily increasing exercise. Should good recovery not be obtained there may be some improvement following manipulation in order to break down adhesions. Finally if the pain is very severe, and responds to none of these conservative methods an arthrodesis of the spine may be performed.

BLOOD-VESSELS

The commonest form of degeneration of the blood vessels occurs in the middle coat of the vessel wall Here the muscular tissue is replaced by fibrous tissue which may later become calcified. The condition is known as *arteriosclerosis* The heart has difficulty in pumping blood through the hardened arteries, and so the blood pressure is raised by the body in order to get oxygen through to important tissues

The thickening of the arteries to the lower limbs becomes of surgical importance because the reduced blood supply may cause pain in the calf muscles after walking or may even result in gangrene of the extremity Gangrene usually commences in one toe and may follow a small injury, such as cutting a toe nail carelessly and damaging the surrounding skin

In some cases the circulation may be improved by an operation on the sympathetic nerves This will cut out the sympathetic stimulation of the vessels and allow them to dilate, but if the vessels are badly sclerosed, dilatation will not be possible. The operation is performed by exposing the sympathetic nerves at their origin from their ganglia on the front of the vertebral bodies, behind the peritoneum the ganglia are then removed

If gangrene occurs the part will have to be amputated. Simple amputation of the toes or through the foot *may* be possible but, owing to the poor circulation, the wound may not heal. In this case the amputation will have to be done higher up where the circulation is better and it frequently must be performed above the knee.

Diabetes is often accompanied by disease of the arteries and, in any case of gangrene, the urine should be examined for sugar and the diabetes treated, if present.

Syphilis also has a serious effect on the middle coats of the blood vessels, and syphilitic degeneration may be too rapid for the body to make any attempt at repair by fibrous tissue. In this case the vessel may suddenly dilate at one point. This is known as an *aneurysm* An aneurysm may steadily grow and cause pressure on nerves and other structures, or it may even burst. An aneurysm should be excised if at all possible.

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ENDOCRINE DISEASES

Diseases of the endocrine glands result either from a destruction of the endocrine gland due to disease or from an overgrowth of the gland, either as a simple overgrowth or as a benign or malignant tumour

The result will be either an under secretion or an over secretion of the glandular hormone.

If there is under secretion, as in diabetes, the physicians treat the case by giving the patient injections of the missing hormone.

If there is over-secretion, the surgeon may be asked to remove either the whole or part of the affected gland. In European practice the commonest example of such an operation is the removal of seven-eighths of the thyroid gland for thyrotoxicosis. This is a very rare disease amongst Africans, and operations on the thyroid are most commonly performed for an unsightly en largement without any excess secretion of hormone.

PART TWO

REGIONAL SURGERY—THE LIMBS

CHAPTER 13

INJURIES AND INFECTIONS OF THE HAND

THE hand is not a vital structure like the heart, brain, kidney or liver but, if a person is alive and well, the hand is one of the most important and useful structures in his body

Its value is so great that it is considered advisable to devote a whole chapter to the treatment of injuries and infections of the hand.

ANATOMY AND FUNCTION OF THE HAND

The most important anatomical principle of the hand is its ability to place the fingers rapidly and easily in many positions for touching pinching and grasping The thumb in a human being can be placed opposite the fingers and thus greatly increases the power of grasp Almost no other animal can oppose its thumb in this way and every effort must be made, in treating injury or infection of the hand, to preserve this faculty of opposition

The rest of the upper limb has really only one important function, and that is to place the hand where the individual wishes it to be placed, and then move it somewhere else, as required

The hand is provided with a very rich nerve supply Most of the sensory fibres travel in the median and ulnar nerves, which enter the palm across the front of the wrist and then divide to supply the skin of the front and back of the hand and of the fingers and thumb the radial nerve only supplies a very small portion of skin on the back of the hand, in the web between the thumb and index finger

The very important movements of the thumb and fingers are controlled through all three nerves. The median nerve is largely responsible for flexion of the fingers through its supply to the

finger flexors in the forearm it also supplies the small muscles at the base of the thumb, including in most persons the important power of opposition.

The ulnar nerve supplies the ulnar flexor of the wrist, and it may supply the flexors of the little and ring fingers in the forearm. It also supplies the small muscles at the base of the little finger However, *its most important motor* supply is to the little muscles in the palm of the hand—the interossei and the lumbricals occasionally it may pass across the palm far enough to supply the muscle of thumb opposition The lumbricals and interossei have two functions. The first one is to separate the fingers and draw them together again the second one is to *extend* the joints between the phalanges of the fingers while the metacarpo-phalangeal joints are *flexed*. This they can do because their tendons pass round the side of each finger to join the extensor tendons The second function is the more important.

The radial nerve provides power to the extensors of the wrist and of the metacarpo phalangeal joints.

In a paralysis of the radial nerve there is a drop wrist and flexion of the fingers where they join the palm (the metacarpo-phalangeal joints) In an ulnar nerve paralysis there is loss of sensation in the medial fingers the fingers are extended backwards at the metacarpo-phalangeal joints by the radial extensors, *and they are flexed forwards at the interphalangeal joints* by the flexors supplied by the median nerve. In a median nerve paralysis the thumb falls back into the same plane as the palm of the hand *and cannot be opposed to the fingers If the median nerve* injury is high up in the arm, the finger flexors also will be paralysed.

The common paralysis of *leprosy results from a paralysis of* the ulnar nerve at the elbow and of the median nerve at the wrist. The fingers are clawed backwards, and the thumb lies flat in the plane of the palm the result is a *serious loss in the power of* grasp Considerable improvement may be obtained by using some of the finger flexors for tendon transplantation.

Every endeavour must be made to maintain the *mobility* and function of the hand whatever the cause of injury or infection.

Apart from deformities caused by mal united fractures or loss of function caused by division of nerves or tendons, *the most* crippling condition met with is stiffness due to fibrosis following oedema

All serious hand infections or injuries *must* be treated by elevation and by active exercises as soon as possible for every part that is not splinted or held firmly by plaster of Paris.

Position of function

When the hand is in the position of function the forearm is held half way between full pronation and full supination the wrist is slightly dorsi flexed, the thumb is in a straight line with the radius and its interphalangeal joint is very slightly flexed. The whole thumb must lie at right angles to the plane of the palm (if it is placed in the same plane as the palm it cannot be opposed to any of the fingers) All the finger joints are held comfortably flexed the amount of flexion is least in the index finger and greatest in the little finger The position is the one that the hand naturally takes when grasping a small rubber ball or holding a pen when writing and this is the position in which the hand should be placed during any form of treatment. The amount of flexion of the fingers may be increased, for example when treating fractures of the phalanges but the fingers should *never* be treated on straight splints unless there has been a repair of extensor tendons

SOFT TISSUE INJURIES

Skin

Injuries of the hand are treated in the same manner as those of other parts. The blood supply is normally very good, with the result that good healing is achieved as long as dead tissue is excised and infection does not occur In stitching fingers great care must be taken to see that they are not stitched tightly, as swelling may then cut off the blood-supply to the distal part of the finger with resulting gangrene. If there appears to be any tension present the wound should be left unstitched until swelling has subsided.

A crushing injury or a third-degree burn may result in full-thickness loss of skin later repair by scarring will then cause contractures to develop with limitation of fine movements

Full thickness skin loss should be replaced by full thickness skin grafts, and scars should be excised and replaced with normal skin. The usual thin graft used on tropical ulcers and other sites has a tendency to shrink afterwards, and it rarely regains full

JOINT INJURIES

The interphalangeal joints may be sprained or even dislocated by a twisting strain Any dislocation is readily reduced by traction, and the finger is then rested for one to two weeks After the rest, active movements are prescribed to restore function.

If however, the ligaments at the side of the finger have been torn, rest may have to be prolonged for three or four weeks to allow the ligaments to heal One of the best ways to splint an interphalangeal joint is to strap the injured finger to the next finger with adhesive strapping Two pieces are used one round the phalanges proximal to the joint and the other round the phalanges distal to the joint.

CLOSED FRACTURES

Phalanges

When the phalanx of a finger has been fractured, the pull of the tendons on the finger causes deformity The fracture is usually transverse, and the distal fragment becomes angled backwards on the proximal fragment. If the fracture is left in this position there will be considerable loss of function further, if the deformity is corrected and the finger then treated in a straight splint, the tendons will cause the deformity to reappear despite the splint or plaster

The deformity must be reduced by traction and then *flexion* of the digit the finger is then splinted in the flexed position of function. Cramer wire or plaster of Paris may be used. The fracture should normally be united in three weeks.

Metacarpals

There is usually very little displacement in fractures of the *shafts* of the metacarpals and they unite in about three weeks if they are kept at rest in plaster leaving the fingers free. The plaster includes the whole of the forearm and wrist, but stops just below the metacarpal heads.

Almost every plaster of the upper limb extends down to include the wrist, but it must never be extended past the meta carpal heads, unless the metacarpal necks or the phalanges are fractured, otherwise movement of the fingers will be limited The metacarpal heads do not lie opposite the clefts of the skin

between the fingers but are opposite the creases in the skin which run across the palm. The plaster must stop just short of these creases

If the metacarpal of the thumb has been fractured the thumb must be put in its position of function and the last joint left free. Sometimes a fracture of the thumb metacarpal is right at the base and enters the joint between the metacarpal and the wrist (the carpo-metacarpal joint) In this case there will be shortening of the thumb, and it must be treated by continuous traction as well as by plaster fixation. A small loop of wire can be fixed into the plaster so that it projects beyond the thumb and then the traction tapes can be fixed to the loop This fracture is known as a *Bennett s fracture*

A metacarpal may be fractured at its neck, and in this case deformity is usual. The head is displaced backwards with the finger and it must be drawn forward by traction and flexion of the finger as for a fractured phalanx. The hand and finger are then held by a plaster, which will include the finger and hold it in flexion.

INFECTIONS OF THE HAND

Infection may remain localized in the hand or fingers or it may spread by the lymphatics to the axilla and cause a lymph adenitis there. If this occurs both the original infection and the adenitis will require treatment.

Paronychia

This is the name given to infection round the edges of the nail Infection usually manages to get under the nail and lifts it up from its bed No antiseptics can reach the infection there and it may become chronic. If this occurs the loose part of the nail must be cut away and a small piece of gauze packed into the bottom of the small abscess cavity A daily 20 per cent saline dressing will then encourage quick recovery

Pulp infection of the finger

The pulp of the finger is the soft pad which lies on the front of the distal phalanx it is very important for the power of touch and feeling The pulp is composed of a pad of fat and fibrous

tissue the fibrous tissue lies in bands which separate one part of the pulp from another

Infection may follow a small prick of the pulp with a sharp needle or thorn. The usual swelling of infection occurs and this gives rise to very severe throbbing pain, for the bands of fibrous tissue prevent expansion and cause great tension and the pulp has a very large supply of sensory nerve-endings.

If the infection does not resolve rapidly, the tension frequently becomes so great that it cuts off the blood supply to the bone of the distal phalanx. In this way an osteomyelitis of the bone will be caused. When the abscess bursts or is incised infection and discharge of pus will continue until the bone has been sequestrated and removed

For these reasons a pulp infection must be treated very seriously If it is seen within a few hours of onset the patient should be given 500 000 units of soluble penicillin twice daily and resolution usually occurs in twenty four to forty-eight hours.

Resolution, however may fail to occur, and pain may be worse at the end of twenty four hours or the patient may not have been seen until the infection is a day or two old In these cases the finger must be incised at once. This is the major exception to the rule that incisions are not made until fluctuation is present.

An incision must never be made through the front of the pulp That would spoil the chief function of the finger tip namely feeling The incision is made at the side of the pulp and it does not extend up beyond the finger tip The incision is made for the full length of the pulp and the knife is passed right across to the other side, sweeping up and down to divide all the fibrous bands. If the infection is severe the knife is carried on through the pulp and skin until it comes out at the other side of the finger

The incision is drained by a small piece of glove-rubber or a gauze wick, and penicillin treatment is continued. The drain is removed at the end of forty-eight hours and 20 per cent. saline dressings are applied daily The incision should be made under a general anaesthetic or with a procaine nerve block. It should never be done under an ethyl chloride spray An ethyl chloride spray only freezes the surface of the skin and the patient experiences very severe pain when the skin unfreezes

Cellulitis

Cellulitis may occur in the subcutaneous tissues of the If pus forms an incision is made and, again, no incisio be made on the front of the finger It may be necessary t the incision past a skin crease, but there will be no inte with function or damage to vessels or nerves if the in placed well back on the side of the finger

Tendon sheath infection

All the tendons of the fingers run in tendon sheaths, lin synovial membrane, in which they can glide freely Th may become infected from a septic thorn or needle-pric the spread of infection from a cellulitis or a pulp infectio

When the sheath is infected, the finger is held flexed a and any passive movements of the finger cause severe pain will also be severe pain on pressure in the palm of the l the proximal end of the sheath.

If the infection is allowed to continue, the pressure of in the sheath will cut off the blood supply of the tendon it. Eventually the pus bursts out of the sheath into th of the hand or the cellular tissue of the finger and then out t the skin. The patient develops a discharging sinus wh continue to discharge pus until the sloughing tendon h thrown out or removed. Meanwhile the whole hand has l swollen and is kept at rest by the patient.

The final result, in a neglected case, is a finger which is because of the loss of its tendon and a hand which is useless owing to the stiffness of all the other fingers

In a severe case like this it is often better to *amputate* fected finger in order to obtain quick healing of the infecti as much restoration as possible of function to the rest of the

The disastrous results of neglect of a tendon sheath in can be avoided by early incision This incision can be through the side of the finger but it is even better to a tourniquet and make a careful dissection across the dist of the palm under general anaesthesia. The proximal the tendon-sheath is then found and incised and the wou open.

Palmar space infections

Inside the palm of the hand the tendons and their sheaths are surrounded by a cavity known as the middle palmar space. Like the pulp of the finger, the contents are loose cellular tissue and fat while the walls are dense fibrous tissue.

Infection may enter from a direct stab, from the spread of a cellulitis of the finger or from a burst tendon-sheath.

The fibrous tissue prevents the infection from spreading for some time afterwards. There is severe pain and loss of function in the hand and fingers, but if the fingers are tested carefully it is found that they can be moved a little. This excludes an unruptured tendon sheath infection. Although the fibrous tissue prevents much swelling of the palm, the loose cellular tissue on the back of the hand swells rapidly and may cause one to think that the infection is on the back of the hand instead of the front. This is a mistake which must be avoided.

If a palmar-space infection has been diagnosed, the space must be incised. If this is not done the pus may not burst through the skin of the hand but may travel up under the fibrous bands across the wrist, into the forearm. It will then come to the skin surface and burst there

The palmar space is incised in the hand by an incision which is made parallel to or along the skin-creases No skin-crease on the hand should ever be cut *across* or the scar tissue formed during healing will limit movement. Alternatively incisions may be made at the sides of the hand, either in front of the fifth metacarpal or in front of the second metacarpal, or in both places.

If the infection has spread to the forearm, incision will be required there also The incisions are again made from the sides of the limb in front of the radius and ulna.

Finally all hand and finger infections must be treated by active exercise for all the unaffected fingers and bandages must be applied so as to allow this to be done. The hand is elevated on pillows, and penicillin is given in doses which vary according to the severity of the infection.

CHAPTER 14

INJURIES OF THE UPPER LIMB

THE WRIST

Open wounds

Cuts in the front of the wrist are not uncommon. They may occur in a fight with knives or an accident in which the patient has tried to protect himself in falling through a pane of glass. The latter cause is not now so frequent because motor-car windscreens are made of material that breaks into small fragments instead of jagged splinters.

Many important structures leading into or from the hand pass across the front of the wrist. Of these the most superficial, and most easily injured, are the subcutaneous veins These will bleed freely, but the haemorrhage can readily be controlled by elevation of the limb and the application of a dressing and bandage or as a first aid measure, by the tying of a handkerchief round the wrist. The veins may require ligaturing at the time that the wound is stitched.

The next important structure is the median nerve, which lies towards the radial side of the main group of tendons and is quite superficial.

If a cut is deeper the tendons themselves may be divided then the radial artery the ulnar artery and the ulnar nerve. Finally the cut may be deep enough to cause a compound fracture of the lower end of the forearm bones or it may enter the wrist joint.

The paralysis which results from division of the median or ulnar nerves is described on pages 109 and 110

On admission to hospital the patient will be examined for tendon and nerve injuries, and these will be dealt with appropriately (see Part One) The collateral circulation round the wrist is very good and there is very little risk of gangrene following division and ligature of both the radial and ulnar arteries care must be taken however to elevate the limb and make sure that the remaining circulation is not cut off by tight bandages or plaster

Closed injuries of bones and joints

Owing to the very strong ligaments round the wrist the joint is very rarely dislocated any force which could dislocate the joint is much more likely to cause a fracture of the lower end of the radius.

Fracture of the scaphoid

The scaphoid is a small bone of the wrist which lies just proximal to the thumb and index fingers. It may be fractured by a fall on the outstretched hand Deformity does not occur but union is very often delayed because the fracture has cut across the blood supply of one half of the bone. The fracture is treated by plaster of Paris which includes the thumb metacarpal in the position of function the plaster is left on for six weeks At the end of six weeks very careful check X rays are carried out and, if there is no union the plaster is repeated If there is delay due to a poor blood-supply union may not take place for possibly six months. If non union is allowed to occur the patient will later develop an osteoarthritis of the wrist, for which he may require an arthrodesis.

The other bones of the wrist are rarely fractured.

Colles fracture

This is the name given to a fracture of the lower end of the radius Like the fracture of the scaphoid, and many other injuries of the upper limb it is frequently caused by a fall during which the patient has stretched out his hand to save himself

The fracture passes transversely through the radius about half an inch above the wrist joint, and the area of maximal tenderness is over the fracture line.

The lower fragment is forced backwards and rotated away from the ulna. The deformity is very easily recognized. It is reduced by traction on the hand by one person while another person pulls the opposite way on the upper arm the lower fragment is then manipulated forcibly forwards and towards the ulnar side.

Reduction is maintained by a plaster of Paris splint along the back of the forearm and hand as far as the metacarpal necks and the splint is held in position with a wet cotton bandage.

A check X ray is taken to confirm reduction, and the patient immediately starts finger exercises while keeping the limb elevated. After three to five days swelling will have subsided and the cotton bandage may be replaced by one of plaster of Paris. The complete cast is worn by the patient for five weeks and he should be able, while wearing it, to do all work except heavy manual labour

Anterior displacement of lower radial fragment

This fracture is caused by a fall on the back of the wrist and it is much less common than a Colles fracture. It is sometimes called a *Smith's fracture* and sometimes a reversed Colles' Treatment is the same as for a Colles fracture, but the manipulation will naturally be done in the reverse direction.

THE FOREARM

Fracture of the ulna

The ulna lies close under the skin along the medial side of the back of the forearm. If a person is threatened by a blow that may strike his head he frequently raises his arm in defence, and the full force of the blow is then taken by the ulna The resulting fracture may be simple or compound, depending on the nature of the weapon with which he was struck.

In the treatment of a Colles fracture the plaster need only extend to the upper end of the forearm. In ulnar fractures, however the plaster must be extended past the elbow This is because a low radial fracture is not disturbed by rotation for part of the function of the radius is to rotate round the ulna. The ulna should remain as a rigid bone round which the radius can turn a fracture breaks that rigidity which can only be restored and maintained by fixing both the wrist and elbow joints in plaster If rotation is permitted then delayed union is probable and non union possible

The elbow is usually placed in plaster so that the arm and the forearm are at a right angle but if both forearms have been injured one of the elbows must be flexed sufficiently for the patient to be able to reach his mouth with that hand

The plaster should not stop just above the elbow but should include the whole of the upper arm. If this is not done the upper

reduction is required in order that pressure on the artery may be relieved thereafter one must make sure that no tight bandages or plasters are applied.

If the blood supply is completely cut off, the patient may lose his hand or forearm from gangrene. On the other hand a severe reduction in blood supply which is not enough to cause gangrene, will cause an ischaemic necrosis and contracture of the forearm muscles Ischaemic contracture is most commonly seen in this site although it may sometimes occur in the calf muscles after leg injuries

The median and ulnar nerves also may be damaged at the time of injury or have their blood-supply cut off. This complication will make the paralysis and contracture worse but it is not common

Supracondylar fracture of the humerus

As the name implies, this is a fracture which lies just above the condyles of the humerus. It is most common in children and, as usual, most commonly follows a fall

The fall occurs while the elbow is bent and the radius and ulna are driven upwards and backwards the humerus snaps just above the elbow, and the lower fragment together with the radius and ulna, carries on towards the back of the humerus. The fracture is rarely severe enough for there to be actual upward displacement, but the lower fragment of the humerus is hinged backwards. This becomes most obvious if a lateral X-ray is examined.

Differentiation from a dislocation of the elbow can usually be made by carefully examining the position of the tip of the olecranon in relation to the two humeral condyles. If a student is not sure what the normal positions should be he can always make a check by examining the patient s other elbow

The examination is made as follows one finger or the thumb is placed on the medial condyle of the humerus the next finger is placed on the tip of the olecranon of the ulna, and the next on the lateral condyle of the humerus. If there has been a supracondylar fracture all three will have moved back *together* but if there is a dislocation of the elbow it will be found that only the olecranon has moved backwards

The elbow must on no account be flexed during first aid

treatment, but should be splinted in the position which the patient finds most comfortable

In hospital the fracture is reduced by steady traction and then by forced flexion to carry the lower fragment forwards to its proper position

The elbow must then be kept flexed in order to prevent the deformity from recurring but care must be taken to see that the flexion is not so acute that the circulation is cut off It should be possible to feel the radial pulse at the wrist, and the circulation in the finger nails must be good.

A plaster splint is applied down the back of the arm and over the elbow to the metacarpal necks it is then bandaged on in such a way that there are no tight bands of bandage crossing the front of the elbow

A check X-ray is taken to confirm reduction (if X rays are available) and the patient is returned to bed. The elbow is kept flexed by a collar and cuff sling passing round the wrist and the neck. This keeps the hand elevated and the fingers can be exercised. The circulation is very carefully watched If there is any sign of obstruction to the circulation the bandage must be divided along the whole length of the arm and forearm. If the circulation still remains obstructed the hand must be lowered a little in order to reduce elbow flexion. *It is better for the deformity to recur than for the patient to develop either an ischaemic necrosis of muscle or gangrene of the limb*

If the elbow has been kept flexed, the plaster may be completed after the swelling has subsided and the patient allowed to go home. The fracture is usually united in four to six weeks.

Dislocation of the elbow

Dislocation may occur in either children or adults. The dislocation is usually backwards and can be reduced fairly easily by the same manipulation as that used for supracondylar fractures—namely traction of the forearm followed by flexion of the elbow

Plaster fixation is not necessary after reduction of a simple dislocation. An X ray should always be taken after reduction in order to exclude an associated fracture which may require separate treatment.

The patient wears a collar and-cuff sling for three weeks and

reduction is required in order that pressure on the artery may be relieved thereafter one must make sure that no tight bandages or plasters are applied.

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Plaster fixation is not necessary after reduction of a simple dislocation. An X-ray should always be taken after reduction in order to exclude an associated fracture which may require separate treatment.

The patient wears a collar and-cuff sling for three weeks and

during this time he regularly exercises his wrist, fingers and shoulder As soon as the pain becomes less he can begin to give the elbow gentle exercises. These are steadily increased after the removal of the sling until full power has returned to the muscles and full movement to the joint. This kind of exercising must be done following all fractures or dislocations After elbow injuries the patient must practise hard at pronation and supination as these movements are often more difficult to regain than are flexion and extension.

Fracture of the head of the radius

A mild fracture is treated by rest in a sling for three weeks, if the fracture has gone through the radial head into the joint, however, one part of the bone may be displaced so that there is a risk of osteoarthritis later In this case it is better to perform an open operation and remove the head of the bone altogether

Fracture of the olecranon

When the olecranon is fractured the triceps muscle will tend to separate the bony fragments and they can rarely be brought together, even by treating the elbow in plaster with full extension of the elbow

If separation persists after full extension, the fragments must be brought together by an open operation and then either wired together or fixed by a metal plate, or a screw

After treatment of elbow injuries

Reaction to passive stretching or frequent manipulations of the elbow is probably worse than in any other joint. All exercises and attempts to improve movement must be made by the patient's own efforts

Sometimes an elbow injury may be accompanied by a partial stripping of the periosteum and the formation of a haematoma round the joint and in nearby muscles. This haematoma may be invaded by bone-cells, which will then form bars of bone in the tissues and parts of the muscle close to the joint. This condition is known as myositis ossificans. Active exercise will cause a further spread of the haematoma and the formation of more bone, so early myositis should be treated by rest.

If the bar of bone is large and causes obstruction to movement it can be removed some months later when the activity of repair has ceased

THE ARM

Soft tissues

The important blood vessels and nerves of the arm, with the exception of the radial nerve, all pass down the medial side of the arm and are therefore protected from damage due to most injuries.

The radial nerve begins its course in the axilla and then passes spirally downwards round the back of the arm. In its course it lies very close to the humerus and, in fact, at one point it actually makes a groove in the bone.

In the case of an open wound with a panga or machete, the nerve may be divided and the wound may or may not be accompanied by a compound fracture of the humerus. In a closed fracture also it may be bruised or divided or caught between the fracture ends Cases have also been seen of paralysis of the nerve as the result of the deep injection of drugs, for example emetine. If intramuscular injections are given in the arm they should be given into the deltoid above the level of the nerve but these injections are better given either into the upper and outer quarter of the buttock or into the outer side of the thigh.

The radial nerve is almost entirely a motor nerve. Paralysis of the nerve due to injury in the arm results in paralysis of the extensors of the wrist (drop wrist) of the thumb and of the metacarpo phalangeal joints Sensory loss is confined to a small area on the back of the hand between the first and second metacarpals and a strip along the back of the forearm.

The wrist extensors must be prevented from over-stretching until they have recovered This is done by applying a cock up' splint of metal or plaster to support the wrist in a slightly extended position. The splint is removed every day so that the wrist joint can be put through its full range of movement in order to avoid stiffness The muscles may also be given electrical stimulation in order to reduce the amount of degeneration in them this will only be effective if it is started very soon after the injury and given very frequently

As the nerve is almost purely motor recovery is extremely good, either after simple bruising or after suture. If simple

bruising is suspected the patient is kept under observation for three to four months If there is no recovery after that period the nerve can then be explored.

Occasionally the nerve may be so badly damaged that it cannot be repaired or else the patient may not be seen until many months after the injury In this case very good results can be obtained by transplanting some of the flexor muscles of the front of the forearm to the extensor tendons.

Fractures of the humeral shaft

Fractures of the shaft of the humerus are easily diagnosed, because of the abnormal mobility which appears at the fracture site. After making a diagnosis of a fracture, the next step in examination is to make sure, by testing extension of the wrist, that the radial nerve has not been damaged. This is unusual but we have already pointed out that it can occur and must be treated.

The pull of the arm muscle causes angulation at the fracture site, but gravity pulls the arm downwards and prevents any overriding of the fragments unless the effect of gravity is eliminated by supporting the arm at the elbow

This fact gives the clue to the best method of treatment. The elbow must never be supported, but is allowed to hang down by the patient's side. The elbow joint is flexed and the wrist supported in a collar and-cuff sling Further support is then given to the fractured bone by a U shaped plaster splint, which passes down the outside of the arm, round the elbow and up the inner side to the axilla. The splint is not bandaged on with plaster of Paris, as the plaster would very soon become loose owing to wasting of the muscles It is better to fix the splint with an ordinary bandage, which can be removed and reapplied more tightly every two or three days.

Movement can soon be begun in the wrist and small movements made in the elbow The arm is kept to the side for two to three weeks, and then gentle shoulder exercises can be begun. In the great majority of cases the fracture is clinically united in about six weeks. It is only in very rare cases that non union occurs this may require open operation and complete fixation of the humerus in plaster The humerus can only be completely fixed in plaster if the latter controls the wrist elbow and shoulder-

joints To control the shoulder-joint the plaster must be put on as a shoulder spica round the trunk as well

THE SHOULDER

The function of the shoulder-joint is to provide free movement in every direction The arm may be flexed, extended adducted, abducted rotated and 'circumducted' The last term means that the arm can be moved round in circles a complicated movement which involves the use of all the other movements in turn

Of all the movements at the shoulder the most important are abduction and external rotation If abduction is full the arm may be lifted away from the body until it is parallel to the ground but it cannot be lifted above the head until it is also externally rotated. This can easily be tested on yourself by rotating the arm inwards and then abducting it as far as it will go.

The ordinary position of the arm *in a sling* is that of internal rotation and adduction, and this is unfortunately the position in which the shoulder is placed in the treatment of all injuries that we have so far considered. The shoulder must never be allowed to become stiff in this position abduction and, especially external rotation exercises should be begun as early as possible.

This is particularly important in elderly people as their joints are much more liable to become stiff It must also be remembered that adhesions and stiffness may follow a bruising of the shoulder joint and that the joint may easily be bruised at the same time that a patient develops a Colles fracture.

If there is any serious risk of permanent stiffness the shoulder must be treated in the position of function. The arm is abducted to almost a right angle, and it is then brought forwards and externally rotated a few degrees When it is in the proper position the patient s hand is able to touch his forehead by flexion of the elbow This position may be maintained by a plaster spica or by the support of an aeroplane splint.

Dislocation of the shoulder

In order to allow the very great range of movement required at the shoulder joint, the ligaments of the joint are not strong The main strength of the joint lies in its surrounding muscles A severe strain on the joint may cause it to be dislocated. The shoulder is probably more commonly dislocated than any other joint.

The joint is usually dislocated while the arm is raised above the head, and the upper end of the humerus is then displaced downwards into the axilla in front of the scapula. It remains there when the arm is lowered to the side. The shoulder may also be dislocated by a blow on the back of the shoulder or, again, by a fall on the outstretched hand.

Reduction can be carried out fairly easily by one of two methods It can be done without an anaesthetic if it is done slowly and carefully, but it is more comfortable for the patient if a general anaesthetic is given. Also if the anaesthetic is deep enough, the muscles will be fully relaxed.

Method one The secret of this method is to obtain first of all, full external rotation of the humerus The elbow is flexed, one hand holds the elbow fixed to the patient's side and the other takes hold of his wrist and then slowly but steadily rotates the humerus outward. When this has been done, but not before, the elbow is carried across the patient's chest while the hand holding the wrist maintains the external rotation The head of the humerus usually slips back into position. The most important step is the *slow* external rotation.

Method two This method may be used at once or if method one fails It is called the Hippocratic method, as it was first described by Hippocrates more than 2,000 years ago

The patient lies down on a couch and the surgeon standing opposite the patient's thighs and facing his head, takes off his own shoe from the foot nearest the patient. He then takes hold of the patient's wrist with both hands and places his foot in the axilla. Traction is exerted on the arm which is then carried (adducted) across the patient's body The surgeon's foot acts as a fulcrum for the long lever and the head of the humerus moves outwards into its proper position.

After treatment

After the dislocation has been reduced the arm is kept in a collar and-cuff sling for three weeks. This keeps the arm internally rotated and allows the joint capsule to heal. After the first few days gentle shoulder movements are begun but full external rotation and abduction are not tried until the whole three weeks has elapsed

If this precaution is not taken the hole in the capsule may never

heal and the patient is liable to develop a recurrent dislocation whenever he strains his arm above his head

Recurrent dislocations are reduced very much more easily each time that they happen, but the liability to dislocation is a definite disability, and open operation may be required to repair the hole in the capsule.

Fractures of the upper end of the humerus

Fractures of the neck of the humerus are so close to the joint that they are included here as shoulder injuries.

There are several varieties of fracture of the humeral neck that require special knowledge for their correct treatment. Some mild ones, with very slight displacement, may be treated simply in a sling, while others will require the support of an aeroplane splint to correct deformity and possibly continuous traction on the arm to maintain reduction

Rupture of the supraspinatus tendon

The supraspinatus tendon passes over the top of the shoulder-joint, coming from the back of the scapula and passing underneath the acromio-clavicular joint. It is responsible for the first few degrees of abduction of the arm, as the position of the deltoid does not allow the deltoid to abduct until the arm is already a little way out from the side of the body

The tendon of the supraspinatus degenerates as a patient becomes older and it may be ruptured if too great a strain is put on it. The patient has then quite considerable disability as he cannot begin the movement of arm abduction. In these cases the tendon must be sought at open operation and sutured.

Fracture of the clavicle

The fracture is usually caused by a fall in which the patient lands on his shoulder The clavicle gives way towards its outer end and the shoulder is allowed to move forwards and inwards by the overriding of the bone-ends.

The deformity is corrected by the reverse movement of bracing the shoulder joints backwards It is then held in position by a figure-of-eight bandage passing round the front of each shoulder and crossing over at the back of the patient.

The patient sits on a stool and braces his own shoulders back with his hands on his hips. Pads of wool or felt are placed in the axilla, and the figure-of-eight bandage is applied with plaster of Paris

Healing is extremely rapid and is almost always complete when the plaster is removed at the end of three weeks As a rule no X rays are necessary

Fracture of the scapula

The scapula may be split by a direct blow over the bone. The bone is well surrounded by muscles displacement is slight and, if it does occur it is unimportant. The muscles hold the broken pieces of bone together and they unite in about three weeks The arm is kept at rest for a short time to relieve pain and then is exercised by increasing amounts

Tear of the brachial plexus

The brachial plexus may be torn by a fall from a height on to the side of the head and shoulder The head and shoulder are forced apart and the nerves passing from the neck to the arm are torn across, close to their origin, or are pulled out by their roots from the central nervous system. The author has seen only two cases and both arose from the bad habit of African labourers who stand in the back of lorries travelling at high speed. They may then be thrown out of the lorry on to the road as the lorry turns a corner

Recovery from a traction injury is very rare, as the nerves have been badly damaged and are repaired by dense scar tissue which the axons cannot penetrate.

Paralysis is most marked in the upper roots of the plexus which will paralyse the deltoid and pectoral muscles and possibly the flexors of the elbow

If paralysis is permanent the patient s condition may be improved by arthrodesing the shoulder in the position of function and either arthrodesing the elbow at a right angle or transplanting the triceps tendon round to the front of the arm and attaching it to the lower end of the biceps.

CHAPTER 15

NERVE AND OTHER LESIONS IN THE UPPER LIMB

INJURY

THE more common injuries to the upper limb nerves have been discussed in the last chapter They were division of the median or ulnar nerves associated with a cut wrist, bruising or division of the radial nerve in association with a fracture of the humerus, and a tear of the brachial plexus due to a fall on the side of the head and shoulder

BIRTH PALSY

Sometimes a child may be born with a paralysis of an upper limb This is not a congenital lesion due to any fault in development but the result of a traction injury which takes place at the time of birth. It rarely follows a normal delivery but it may be the result either of a forceps delivery when the head is delivered first and there is difficulty in extracting the shoulders or of a breech delivery when the child comes out feet first and there is difficulty in extracting the after-coming head. Too much force may be applied by the midwife or doctor in trying to extract the child and the brachial plexus becomes damaged.

The most common type is an injury to the upper roots of the plexus, with the result that the paralysis affects the deltoid, pectorals and biceps. The arm hangs by the side, and as the biceps can no longer supinate the forearm the hand is rotated inwards by the pronators.

In the majority of cases the nerve roots have only been bruised, and recovery takes place within a month. Meanwhile the infant must have the paralysed muscles rested on a small aeroplane splint, which can be made from Cramer wire.

Sometimes especially following breech delivery when the child s arm may be stretched above its head, the main force of the injury falls on the lower roots of the brachial plexus. This results in a mixed motor and sensory paralysis that affects the

small muscles and skin sensation in the hand If recovery does not occur, the result will be very similar to the paralysis caused by leprosy (see below)

SPASTIC PARALYSIS

A type of paralysis is sometimes seen in infants in which the muscles are stiff and the child cannot control them properly Frequently the paralysis affects speech also and the child may be slightly mentally defective.

One of the principal causes of spastic paralysis is damage to the motor cells in the brain by haemorrhage into the brain which may follow squeezing of the head during a difficult delivery

There may be constant, uncontrolled movement of the upper limbs and muscles of the face, and when the child attempts to grasp anything or to speak, the muscles go into severe spasm.

Very little surgical treatment is available, but the child if it is intelligent enough, may be trained by physiotherapists to exert a better control over its muscles. The chief thing the child has to learn is how to relax.

LEPROSY

In the upper limb leprosy most commonly affects the ulnar nerve at the elbow and the median nerve at the wrist frequently only an ulnar paralysis is seen. Paralysis may sometimes be prevented by incision of the affected nerves in the early stages

The paralysis is both motor and sensory and the deformity that develops shows which nerves are affected.

No treatment is available to restore function to the nerves in the late stages, as they contain dense fibrous scar tissue which compresses the axons

Considerable assistance, however, can be given to the patient by tendon transplantation operations As the median nerve is rarely affected above the wrist, the flexors of the fingers are intact and it is possible to make use of the superficial flexors to take the place of the paralysed small muscles

The superficial flexor of the ring finger can be taken across to the thumb in order to restore its power of opposition and the remaining flexors can be taken round to the back of the fingers and attached to the extensors so that they take the place of the lumbricals and interossei

POLIOMYELITIS

myelitis is distinguished from other forms of paralysis by act that it is a purely motor paralysis with no sensory loss hat the paralysis is most irregular in its distribution.
e have seen that a tear of the upper roots of the brachial is will give a paralysis of the deltoid, pectorals and biceps a median nerve injury will give a paralysis of the small les of the thumb In poliomyelitis there may be a paralysis e deltoid and of thumb opposition while the biceps and the thumb flexors escape or there may be any other combina- of muscle paralysis The extent of the paralysis also varies. muscles may be weak, some very weak and some totally yzed.
nce the diagnosis has been made, treatment will be carried s described in Chapter 9
hen the stage of final recovery has been reached, the patient be carefully examined to see if there is anything further that e done In doing this, it is remembered that the purpose of les is to move joints Each joint is examined in turn in r to see what movement the patient has lost.
there is total paralysis of the arm, there will be no point in rodesing the shoulder or any other joint but if the patient has ul function in the fingers, he will be able to make some use of limb if shoulder elbow and wrist are arthrodesed in the tion of function. In other cases, tendon transplantations be carried out. Examples of these are, transplanting the ps to the biceps as in a brachial plexus injury transplanting arm flexors to take the place of weak extensors as in a radial y and transplantation of finger flexors as in ulnar paralysis

OSTEOMYELITIS

eomyelitis is rare in the small bone of the finger and hand, but ay occur occasionally in the humerus, radius and ulna.

MALIGNANT TUMOURS

coma may develop in muscle or bone. A rapidly growing oma of bone may cause local pain, heat and redness, and refore it may be mistaken for an acute osteomyelitis. If an

apparent osteomyelitis does not appear to be behaving as it should, an X-ray should be taken, to exclude a sarcoma. It is dangerous to incise a possible sarcoma either in the mistaken diagnosis that infection is present or to take a biopsy specimen for laboratory examination. The incision may lead to a rapid spread of the tumour through the body

If the diagnosis is made by clinical or radiological methods the limb should be *amputated* as soon as possible. The prognosis, however, will be very bad, particularly if an X ray of the chest shows that secondaries are already present in the lungs

An *epithelioma* of the skin is not often seen in the upper limb but may develop in an albino following prolonged exposure to the sun It is then found most frequently on the exposed shoulders

ARTHRITIS

Septic arthritis

Septic arthritis may occur in any of the larger joints of the upper limb An acute septic arthritis of the shoulder is particularly common in infants The shoulder joint may require repeated aspiration or even incision in order to provide drainage but, fortunately, recovery usually follows modern treatment with penicillin if the condition is diagnosed early enough. The diagnosis is not easy to make in a small infant who cannot complain or indicate where the pain is situated, and one must always be ready to find acute arthritis if it exists This difficulty in diagnosis applies to all infants and if an infant has an unexplained high fever, *all the limb joints should be examined.* (The ear-drums should be examined as well for the temperature may be arising from an acute otitis media)

If tension is not relieved at an early stage by aspiration or incision, an acute infection of the shoulder joint may cut off the blood-supply of the head of the humerus, which will then be destroyed. Arthrodesis may be required for the disability which results.

Acute septic arthritis of the shoulder is treated by resting the part on an aeroplane splint, together with traction

If the elbow- or wrist joints are affected they are treated in plaster of Paris in the position of function

Tuberculosis

Tuberculous arthritis is less common in the upper limb than it is in the spine or lower limb, but it should be suspected if chronic arthritis is present.

Gonococcal arthritis

This also is uncommon in the upper limb, but it may affect the wrist.

Frozen shoulder

Middle-aged patients sometimes develop a very stiff painful shoulder The exact cause of this has not been discovered, but it appears to be an inflammation of the ligaments and soft tissues round the joint and so can be called a periarthritis of the shoulder Heat and exercises may be tried but give very little relief. The patient, however feels that something has been done to help him, and further courses of treatment may be repeated from time to time. In the course of a year to eighteen months the pain and stiffness slowly disappear

BRACHIAL NEURITIS

Like sciatica, brachial neuritis was formerly thought to be due to actual inflammation of the nerves. It is now considered that most cases result from irritation of the roots of the nerves in the spinal canal The irritation may be caused either by prolapse of an intervertebral disc or by arthritis of the intervertebral joints of the cervical spine.

Most cases respond to rest in bed, and this may be accompanied by heat and deep massage in order to relieve the spasm of the cervical muscles. Traction applied to the neck joints by a head halter and weights is often a great help

In chronic cases, a manipulation of the neck may help to break down adhesions round the joints, but this must be done very carefully and without an anaesthetic, in case the manipulation is carried too far and the spinal cord is damaged.

CONGENITAL ABNORMALITIES

Additional fingers

Sometimes, in development, an extra finger may be formed or one finger or the thumb may be doubled. The extra finger

usually appears on the ulnar border of the hand just above the little finger It is easily excised and this can be done soon after the child is born.

Double fingers have to be dealt with more carefully The finger or thumb may be double the whole way up or only in the last one or two joints and before removing the extra portion the surgeon must decide which one will be of most use to the patient.

Webbed fingers

In webbed fingers the fingers have failed to separate during development and they may be webbed together with skin either at the base only or the whole way up

It is quite easy to divide the web but the skin available after the division is quite insufficient to cover the resulting raw surfaces. If skin-grafts are not applied the scars which result from healing will cause considerable deformity and disability when they contract.

When normal adult fingers are separated, there is nearly half an inch between them at their bases on the palmar side. This gap must be filled with skin if full function is to be restored, either following congenital webbing of the fingers or scarring from deep burns The grafts should be composed of the full thickness of the skin because thin Thiersch grafts will contract and the disability will recur

plasters

g plaster is a plaster cast that extends from the groin just below the knee to the heads of the metatarsals A rubber tyre is then added to the plaster so that it lies front of the heel. The patient is then taught to walk otherwise he may develop a bad habit of walking which difficult to correct after the plaster is removed.

a person is walking properly he places one leg in front ther he then lifts the heel of the leg that has been left until only the toes are touching the ground and the knee e forward to the same position as the other knee. Not does he lift the second leg off the ground and carry it As soon as one foot has passed the other the knee is ened and the leg reaches the ground, heel first, in front ther foot. The important points to remember are bring the knee until it is opposite the front knee, lift the whole ard, straighten the knee and put the heel on the ground e plaster extends to the groin, the knee cannot be bent, patient can still walk well by tilting his pelvis to lift the off the ground. He should not swing the leg out to the try to walk with the good leg in front and the bad one behind.

tient can often be taught to walk in plaster, or after a has been removed, by teaching him first of all to mark hat is to raise and lower each foot in turn on the same This makes him learn to put weight on the damaged leg he learnt to do this with confidence he can then be e forward with gradually increasing steps.

THE FOOT

of the toes may be caused by a crush me of bare footed football The toes nt mobility that the fingers have, ortant. Dislocations and fractures and the toe is then splinted ntil the swelling has subsided the foot of the bed elevated r about, keeping the weight

about his house without having to put on his artificial limb or use crutches.

If disease requires a higher amputation, the next practicable level is a few inches below the knee. Any amputation lower than that passes through an area with a poor blood supply and it does not heal well. The amputation is made five and a half inches below the knee, *if the patient is to be fitted with an* expensive limb which hinges at the knee, but a shorter stump about two inches long is better if the patient is to be supplied with a peg leg in which he will kneel

Sometimes the amputation has to be made through the thigh In these cases the longer the stump that is left, the better

Deformities arising at the joints of lower limbs

Varus and Valgus These are two terms which are met with con *stantly in the description of deformities or injuries to the lower* limb In a varus deformity the part is directed towards the opposite limb whilst in a valgus deformity the part is directed away from the opposite limb

The words are Latin adjectives and they agree with the nouns they qualify Thus part of the deformity of a club foot is a pes *varus* a knock knee is a genu valg*um*, and a diseased hip frequently results in a coxa var*a*.

In addition to a pes *valgus or varus the foot may have either the* toes or the heel pointing downward These deformities are known as pes *equinus* and pes *calcaneus*

General treatment of injuries

Most injuries of the lower limb must first be treated by rest and elevation. This can best be done by the patient lying in bed with the foot of the bed raised on blocks If the patient has been in bed for a long time, swelling and oedema of his limb tend to occur after he gets up because the blood vessels have lost their tone The same thing happens after the removal of a plaster The patient must be instructed to look out for this swelling and treat it by repeated *elevation and exercises for a short* while. If the swelling is severe, the leg may have to be treated for a short time with an elastic adhesive bandage.

Walking plasters

A walking plaster is a plaster cast that extends from the groin or from just below the knee to the heads of the metatarsals. A piece of rubber tyre is then added to the plaster so that it lies just in front of the heel. The patient is then taught to walk *properly*, otherwise he may develop a bad habit of walking which may be difficult to correct after the plaster is removed.

When a person is walking properly he places one leg in front of the other, he then lifts the heel of the leg that has been left behind until only the toes are touching the ground and the knee has come forward to the same position as the other knee. Not till then does he lift the second leg off the ground and carry it forward. As soon as one foot has passed the other the knee is straightened and the leg reaches the ground, heel first, in front of the other foot. The important points to remember are: bring forward the knee until it is opposite the front knee, lift the whole leg forward, straighten the knee and put the heel on the ground.

If the plaster extends to the groin, the knee cannot be bent, but the patient can still walk well by tilting his pelvis to lift the bad leg off the ground. He should not swing the leg out to the side or try to walk with the good leg in front and the bad one always behind.

A patient can often be taught to walk in plaster, or after a plaster has been removed, by teaching him first of all to 'mark time', that is, to raise and lower each foot in turn on the same spot. This makes him learn to put weight on the damaged leg. When he has learnt to do this with confidence he can then be encouraged to move forward with gradually increasing steps.

THE FOOT

Phalanges

Fractures and dislocations of the toes may be caused by a crushing injury or during a game of bare footed football. The toes do not have the same important mobility that the fingers have, and slight deformity is not important. Dislocations and fractures are reduced by traction and flexion, and the toe is then splinted by strapping it to another toe. Until the swelling has subsided the patient is confined to bed with the foot of the bed elevated on blocks. He is then allowed to walk about, keeping the weight of his body on the heel.

or possibly to pull off the tip of the lateral malleolus When a small portion of bone has been pulled off the mechanism is known as avulsion.

Once the restraining band on the lateral side has been completely divided, the talus can tilt medially in its socket. An X ray may show no sign of this if it is taken in the usual manner, a further X ray must also be taken with the foot forcibly inverted *in order to show any tilt of the talus that may be present.*

When an X ray shows that subluxation of the ankle joint has occurred, the ankle must be kept at rest in plaster until the ligament or bone has healed otherwise the patient will develop a permanently weak ankle which will be liable to repeated strains when walking on rough ground After swelling has subsided, a walking plaster is applied from below the knee to the metatarsal heads.

Union of ligament or bone will not be sound for eight weeks this makes a very big contrast with treatment of a simple sprain.

(*c*) *Inversion fracture of the medial malleolus* This fracture occurs when the force is even stronger First the lateral ligament is torn or the tip of the lateral malleolus is avulsed, and the talus subluxates the talus is then pressed strongly against the medial malleolus and may have sufficient force to break the malleolus away from the tibia.

The *inversion force may* be carried even farther, until the fibula breaks through the skin on the lateral side, making the fracture compound

An injury with severe displacement will require urgent reduction and if a compound fracture is present, treatment will be *required for the wound. A padded or split plaster* or a plaster splint, will then be applied and retained for two to three weeks. When the swelling has subsided, a further plaster will be applied without padding and any deformity that has not been fully corrected can be corrected at this stage

If displacement is mild, reduction can be delayed until swelling has subsided. A wooden back splint with foot piece is applied the patient is confined to bed with the foot of the bed raised and exercises for the toes are started at once. At the end of a week to ten days the fracture is reduced and a walking plaster applied, extended to just below the knee. The plaster must be retained for eight to ten weeks.

Eversion injuries

If the foot is forcibly everted a number of different degrees of injury will again result, depending on the amount of force that has been applied

(*a*) *Eversion sprain* The ligament damaged in this case is the one on the medial aspect of the ankle. If this is the only damage received, the injury can be treated in the same manner as inversion sprains—that is by supporting the ankle with Elastoplast strapping The patient is encouraged to exercise the foot and ankle, and to walk on the foot as soon as he can do so without pain The ligament will be fully healed in three to four weeks.

(*b*) *Eversion subluxation of the ankle* Subluxation can only occur in an eversion sprain if there is also a fracture of the fibula. On the medial side, either the ligament is torn or the tip of the medial malleolus is avulsed, on the lateral side the fibula is fractured either at the level of the ankle or higher up in the leg In the latter case the lower fragment of the fibula is torn away from its very strong attachment to the lower end of the tibia.

After reduction of the fracture and the subluxation a below-knee plaster will be required for eight to ten weeks. Sometimes an open operation may be required either to nail the lower end of the fibula back to the tibia or to reduce the fracture of the medial malleolus if soft tissue has been turned into the fracture.

(*c*) *Eversion fracture dislocation of the ankle* A very strong eversion injury may cause the subluxation to become a dislocation, and this may become compound if the lower end of the tibia breaks through the skin. A severe displacement will require emergency reduction, in order to relieve pain and to prevent sloughing of the skin where it is stretched tightly over the lower end of the tibia.

THE LEG

Functional anatomy

The important bone in the leg is the tibia. It bears the weight of the body through the femur at the knee-joint and transmits the weight to the talus at the ankle. The fibula is of lesser importance apart from the part its lower end takes in the formation of the ankle-joint, its chief function is to provide the origin and insertion of muscles. A fracture of the fibular shaft alone is

unimportant plaster fixation is unnecessary and the patient can *bear weight on the limb after a few days rest.*

The tibia

The tibia lies close under the skin for its whole length and fractures are frequently compound. This is especially liable to occur if both bones of the limb have been broken, so that deformity can occur and the sharp broken end of the tibia can break through the skin.

Compound fractures

A compound fracture must be treated as an emergency It may be possible to suture the skin after excision of the wound edges *and reduction of the fracture, or it may be necessary to leave the* wound open During the operation all loose bits of bone must be removed and the fracture reduced and supported with a padded or split plaster which extends from the groin to the toes. The limb is elevated by raising the foot of the bed. Exercises for the toes and quadriceps are begun at once.

The fracture may follow a street accident and be accompanied by considerable bruising and infection of the wound If this is *the case it will be unwise to suture the skin Osteomyelitis of the* bone-ends may develop despite high doses of penicillin The plaster will then require to be changed repeatedly until all sloughs and sequestra have been removed and the fracture can begin to unite.

The position of the bones and the length of the limb may be maintained during plaster changes by the following method The plaster is split down both sides (bivalved) and the top half of it is removed *This allows the wound to be cleaned and re-*dressed or packed with soft paraffin gauze while the limb is still supported on the posterior half of the plaster A fresh plaster splint is applied to the front of the limb and allowed to set hard before the other half of the plaster is removed and replaced and the plaster completed

Very great care must be taken during all these plaster changes to prevent the development of a pes equinus *The foot must be kept at right-angles to the leg*

Penicillin need no longer be given after the acute stage of the infection has been controlled.

Closed fractures

A subperiosteal crack fracture may be caused by a mild injury, especially if the bone has previously been rendered hard and brittle by yaws infection. There is no deformity, and the fracture heals in five or six weeks if it is protected by a walking plaster cast

The most usual closed fracture is a fracture of both bones with sideways displacement of the fracture ends and some shortening The fracture of the tibia is sometimes transverse, but it is much more common for it to be spiral or oblique.

If a transverse fracture is reduced it will remain stable with plaster fixation, it is not easy however, to get good reduction or to maintain reduction with an oblique fracture, as the bones can easily slide back into deformity again If the shortening is only half an inch it is better to accept the shortening and thus get quick healing and early movement of the joints with little stiffness, rather than take the risks which go with traction or open reduction.

Shortening which is more than half an inch should be corrected. This may be done by traction or by open reduction and applying a plate or inserting a stainless steel screw

Traction is applied by driving a Steinmann's pin through the lower inch of the tibia, attaching a stirrup to the pin and treating the fracture on a Braun's splint with a weight of five to ten pounds passed from the stirrup over the pulley on the splint. One must remember the danger of distraction with its risk of delay in union and the weight should never exceed ten pounds The foot of the bed is raised on blocks so that the weight of the patient will pull in the opposite direction After about four weeks the fracture should be beginning to unite by callus and it will be possible to apply a plaster cast and remove the pin.

Open operation gives very satisfactory results as long as it is done carefully with the minimum of bruising of tissues and with careful asepsis. Any plates or screws that are inserted are put in from the lateral side so that they do not lie close under the skin. After open reduction and screwing or plating, the leg must be supported in plaster from the groin to the toes

Plaster treatment of leg fractures

The plaster used for a fracture of the leg must extend from the groin to the metatarsal heads whether the fracture be compound,

closed or treated by open reduction and whether the patient is in bed or allowed to walk. The plaster must be kept on beyond the time when the fracture has united till it has consolidated enough for the leg to bear weight alone. The shortest time for which a plaster should be applied is ten weeks.

The full length of the plaster to the groin is required in order to fix the knee and so prevent movement of the upper end of the fracture. Movement will still be able to occur by rotation inside the plaster if the knee is not kept slightly bent. The knee should *not be bent more than about ten degrees, otherwise it is impossible* for the patient to exercise his quadriceps muscle properly The patient should exercise his quadriceps from the first day after the injury, by both contracting and relaxing the muscle and by *lifting the whole leg off the bed in its plaster The last exercise* cannot, of course, be done if traction has been applied to the lower end of the leg

In all cases of fracture of the leg the patient must not be allowed to bear weight on his plaster until the fracture has begun to unite, and this will be in a minimum of four weeks whether there has been closed or open reduction. Once a walking rubber has been applied and the patient has been taught to walk properly he may return to duty as long as his work does not involve much walking or standing

In a straightforward case he will return to hospital for final removal of his plaster in a further six weeks making a total of ten weeks since injury He will still require to attend the physiotherapy department and carry out exercises at home until full power has returned to the quadriceps and the normal range of movement has returned to the knee and ankle.

THE KNEE

Functional anatomy

The ligaments of the knee are extremely strong and a simple dislocation of the knee is never seen. *It can only occur after* extremely severe violence and is usually accompanied by a fracture of the neighbouring bones.

The strong ligaments of the knee protect the sides and back of the joint the front of the joint is not protected by ligaments but by the quadriceps mechanism consisting of the quadriceps muscle the patella, and the patellar ligament. The *quadriceps*

muscle is constantly used to preserve balance while standing and to extend the knee in one stage of walking No one lying down can attempt to raise the heel from the bed unless the quadriceps muscle is first contracted

For some reason, which is not understood, this simple mechanism goes out of action after any knee or leg injury The quadriceps weakens, and its wasting can often be seen on inspection the wasting can be measured with a tape measure passed round the thigh. The result is a weak, unstable knee which is never fully extended. Fluid in the joint collects under the patella and the other recesses of the joint and cannot be absorbed every small strain on the knee causes a fresh effusion

In order to obtain full recovery from any knee or leg injury the patient must be retaught how to use his quadriceps He is first shown, on his undamaged leg how the quadriceps automatically contracts before he raised his heel and he is then encouraged to make the same effort with the injured leg

The patient must carry out his exercises repeatedly during the day not only during the short time that he visits a physiotherapy department but for several minutes every hour He must contract and relax the quadriceps by itself and, if the leg is not fixed to a splint, he must raise and lower the leg many times a day If he has a plaster which extends to the groin he may be able to cheat by raising the leg with hip flexion without ever contracting the quadriceps, and it must be seen that he does not cheat in this way

Every time a medical assistant or surgeon passes the patient s bed he should pause for a minute or two and again encourage him in his efforts In this way the patient will have a well-developed quadriceps when his bone or joint injury has healed, recovery will be greatly accelerated and the patient will have little chance of developing a chronic traumatic synovitis of the knee-joint.

Acute traumatic arthritis (or synovitis)

It has just been explained why recovery from knee injuries may be extremely slow if proper attention is not paid to a knee effusion and the associated weakness or apparent paralysis of the quadriceps muscle.

The knee is the joint in which traumatic arthritis most com-

monly develops Following a sprain, fluid rapidly collects in the joint and lifts up the patella. If the sprain is followed very rapidly by this effusion, then a haemarthrosis is probably present while, if the swelling takes a few hours to develop it is probable that a simple effusion of synovial fluid has formed.

The knee is carefully examined for signs of other injury If none of these is present the joint is aspirated and a Jones bandage applied to reduce the chance of further effusion. A Jones bandage consists of a layer of cotton wool passed right round the joint and for some distance above and below the joint. A flannel bandage is applied firmly over the wool, and on top of this another complete layer of wool is applied Finally a last layer of bandage is applied tightly to give firm even pressure.

The foot of the bed is raised on blocks and the patient is encouraged to exercise his toes and ankle and especially his quadriceps

If quadriceps power is rapidly restored, the bandage can be removed in three to four days and exercises are continued. Any fresh effusion must be treated by reaspiration and bandaging

Chronic traumatic synovitis

This condition may be seen following any leg injury where re education of the quadriceps has been neglected. There is a small quantity of fluid present in the joint, but most of the swelling is due to a marked dough like thickening of the synovial membrane. The quadriceps of course, are markedly wasted. The condition must not be confused with an infective arthritis the treatment is purely that of restoration of the power of the quadriceps and neither sulphonamides nor penicillin are indicated

Injuries to the knee cartilages (menisci)

The tibia and femur are separated from each other by a medial and lateral meniscus of fibrous tissue and cartilage These menisci are attached to the tibia and to the ligaments at the sides of the joint, but their inner edges lie free in the joint space.

Either of them, but especially the medial may be torn by a severe twisting strain such as may occur during a game of football. The patient usually then gives a history that when his

knee was bent he has been unable to straighten it out again This is known as 'locking' of the joint.

On examination an effusion into the knee-joint will be found, together with tenderness over the cartilage between the tibia and femur usually on the medial side of the patellar tendon. The treatment required is an operation to remove the cartilage

The condition is mentioned for the sake of completeness, but it is extremely rare amongst Africans.

Joint sprain

The medial or lateral ligaments of the knee joint may be sprained by a force which tries to abduct or adduct the straight leg The ligament may be damaged at its middle or at its attachment to either bone, and the injury will be accompanied by a traumatic effusion.

On examination the maximum tenderness will be over the damaged ligament or its attachment to bone while if the tear is severe, it will be possible to abduct or adduct the leg on the femur This movement is quite impossible in a normal joint when the leg is straight.

Mild cases may be treated simply by aspiration of the effusion, a Jones bandage, and quadriceps exercises Severe cases will require a groin to-toe walking plaster for six to eight weeks or even an open operation

FRACTURES ROUND THE KNEE JOINT

Fractures of the condyles of the tibia

A strong abduction or adduction injury may tear the ligament on one side of the joint this side of the joint then opens up, hinging on the opposite side of the joint. If the force continues to act, the condyle of the femur on the inner side of the hinge will be forced against the condyle of the tibia and may crush it.

If displacement is slight, the patient is treated with a plaster cast which will be worn for eight weeks, but if the bony displacement is great, then an operation may be required to put the bone back in place.

Fracture of the patella

The patella may be fractured by a direct blow on the knee-cap The fracture is frequently star shaped, but the quadriceps tendon

which passes round the patella is not torn and the disability is not usually serious The patient is treated in a straight walking plaster with the knee fully extended for six weeks.

The patella may also be fractured by indirect action, when the knee is suddenly flexed and the patient automatically tightens his quadriceps. In this case the patella is broken across from one side to the other, and the tendons on either side are also torn so that the bone-ends become separated This injury most commonly occurs in elderly, heavy people.

An open operation is required, the patella fragments may be wired together or the whole of the patella may be excised and the quadriceps tendons sutured together There is less risk of later osteoarthritis if the patella is removed altogether

Supracondylar fracture of the femur

The femur like the humerus, may be fractured just above its condyles. In this case the lower fragment develops a displacement which is very difficult to treat. The gastrocnemius muscle of the calf is attached to the lower fragment behind the knee and pulls it backwards. It then becomes very difficult to rotate the lower fragment forwards again and keep it there. These cases require specialist treatment, but, for first aid, the knee should be aspirated and the leg splinted by traction in a Thomas splint.

FRACTURES OF THE SHAFT OF THE FEMUR

Fractures of the femoral shaft are relatively common. It is unusual for them to be compound unless they have been caused by gun-shot wounds and they are rarely accompanied by injury to nerves or major blood vessels. Many small blood vessels however are torn in the surrounding muscle and the patient may have a considerable internal haemorrhage

A compound fracture of the femur is an extremely serious condition, and there is a grave danger of death from shock owing *to the loss of blood externally and into the damaged muscles.*

In a simple fracture displacement almost invariably occurs. This is due to the great strength of the thigh muscles. Once the bone-ends have been displaced forwards backwards or sideways so that they are no longer in contact with each other the force of the muscles will cause shortening

Reduction is carried out by traction and manipulation, but plaster of Paris is quite unable to maintain reduction at this site, reduction can only be maintained by *continuous* traction

Traction is best applied by the use of the Thomas splint. In this splint the limb is supported by flannel bandages passed under the limb from one bar to the other The bandages under the thigh must be kept tight in order to restore the normal anterior curve of the femur The bandage under the calf is kept looser in order that the knee may be slightly bent. *No* bandage should be placed under the heel or the Achilles tendon, in case a pressure sore develops there.

These bandages and the traction apparatus, must be inspected every day to make sure that good position is maintained. A fractured femur cannot just be left like any other fracture which is encased in plaster Meanwhile, of course, the patient must be taught his quadriceps action and encouraged to exercise his toes and ankle. If the ankle is not exercised regularly it may become stiff in equinus Some surgeons guard against this by applying strapping to the foot attaching a cord to this strap, and then passing the cord over a pulley on a Balkan beam, so that the foot is constantly held up at a right angle. This extra piece of apparatus is unnecessary if active exercises are carried out by the patient and encouraged by the staff

Reduction and traction

Many different methods have been recommended both for the first reduction of the fracture and then for maintaining traction.

Reduction may be carried out by manipulation under a general or a local anaesthetic (10–20 c.c. of 2 per cent. procaine) which will allow the muscles to relax and enable an assistant to pull the leg straight while he stands at the foot of the bed.

The alternative method is to apply slow traction without an anaesthetic this procedure is more commonly adopted, but again two methods are used. In the first the leg is simply fixed to the lower end of the splint, the foot of the bed is raised and the patient allowed only one pillow He will slowly slide up the bed and his fracture will slowly reduce. In the second method the foot of the bed is again raised, but instead of the traction cord being tied to the end of the splint it is attached to a weight which passes over the end of the bed. This method is open to danger

as too heavy a weight may be attached and the fracture may be *dis*tracted with a resulting delay in healing Weights should never exceed fifteen pounds.

Whether fixed traction or a weight is used it may be applied either through a Steinmann pin or by using strapping When a Steinmann pin is used it is inserted through the upper end of the tibia under a general anaesthetic. This can be done in the patient s bed, *traction can then be applied at once, the fracture* manipulated into position under the anaesthetic and the traction stirrup then fixed by cords to the end of the splint. The pin holes in the skin are carefully dressed and bandaged, in order to prevent sepsis passing along the pin to the bone. The objection to this method is that the stirrup prevents the patient from extend ing his knee fully

If strapping is used, ordinary elastic adhesive strapping is unsatisfactory because it can stretch so readily Non-stretch zinc oxide strapping is better, but the best of all is special exten sion strapping which can be stretched sideways but not length ways The strapping is applied from the top of the thigh to the ankle it carries on past the ankle, but is prevented from sticking to the ankle either by separating the ends with a stick or by covering the sticky side with a short piece of strapping sticky side to sticky side. The patient can then exercise his ankle freely

If a long enough piece of strapping has been used it can pass right down one side of the leg and up the other and a piece of wood can be placed below the heel traction cord is fixed to the wood and either tied to the end of the splint or attached to a weight hanging over the end of the bed. The strapping is pressed firmly against the skin by a carefully applied cotton bandage which passes from above the ankle to the top of the thigh This bandage must be very carefully applied so that there are no tight edges which can cut into the limb and cause pressure sores or interfere with the circulation Strapping must *never* be put round a limb but only up and down the sides.

Finally the splint itself must be fixed in some way It may be tied to the end of the bed or it may be hung from a Balkan beam by a pulley and weights In the latter case the upper end of the splint may also be hung from the Balkan beam by pulleys and weights so that the patient can more easily lift himself off the bed for the insertion of a bed pan

The traction apparatus must be inspected daily in order to make sure that traction is continuous. Fresh strapping must be applied if the old strapping has begun to slip

In any case, whatever the method of reduction or traction used, the patient must not be allowed to bear weight on his leg for at least twelve weeks.

There are thus many different methods of reducing the fracture and maintaining traction, but they all give good results in the majority of cases

If an X ray is available and this shows that reduction has not been achieved, then an open reduction may be required and the bone-ends may then be plated together A recent advance in treatment is fixation of the fracture by a metal rod which passes down inside the bone marrow cavity This may be used in place of a plate applied to the outside of the bone. If a plate is applied, the patient will still require treatment by continuous traction until the fracture has united He will also require the usual exercises afterwards in order to restore the strength of the quadriceps and to obtain full movement at the knee joint but if the internal rod is used he can bear weight almost immediately

In children under the age of five, traction may be applied by suspending both legs from an overhead beam. The traction cord is tightened sufficiently for the buttocks to be raised off the cot, and the weight of the buttocks will overcome the spasm of the thigh muscles and correct the shortening of the femur Great care must be taken to see that the strapping and bandage do not reduce the blood supply severely or cause pressure sores behind the Achilles tendon.

THE HIP

Fractures of the upper end of the femur

These fractures may be in the shaft, in the region of the trochanters or through the neck of the femur If the shaft is fractured just below the lesser trochanter the psoas muscle will pull the upper fragment into flexion and the gluteal muscles will abduct the fragment. The case is treated in the same manner as any other fracture of the shaft of the femur, but the leg must be suspended in flexion and abduction in order to bring the lower fragment into line with the upper one.

Fractures just above the trochanters are treated in the same

Fractures of the ring are usually caused by a severe crushing blow or a fall from a considerable height in the latter case there may also be fractures elsewhere in the body

Fractures of the pelvis may be divided into three main types

Simple, single fractures These may occur along the iliac crest or in the iliac bone or through the pubic rami round the obturator foramen. The fracture may pass through both rami above and below the foramen on the same side of the body, but this may be regarded as a single fracture.

Where the ring is only fractured in one part of the circle, there is usually no displacement and no complications The fracture unites quickly, and the only treatment required is to keep the patient in bed for three to four weeks and then to give him gradually increasing exercises. Sedatives such as morphine should only be necessary during the first few days.

Double fractures If the pelvic ring is fractured in two places, deformity usually occurs and must be treated. The fracture may be on either side of the symphysis, and there will then be a tendency for the ring to open out and the bone-ends to separate.

Clinically the site of the fractures may be found by examining for the site of maximum tenderness. The pubic rami can be felt in the inguinal region and lying close under the skin on either side of the perineum An X ray will show whether there is any separation of the fragments, if there is they should be brought together again by laying the patient on his side and applying a plaster spica in that position.

In another variety of double fracture, one fracture is anterior and the other is posterior, close to the sacro-iliac joint on the same or the opposite side.

There may be no displacement; on the other hand one whole half of the pelvis may be driven upwards. The deformity is corrected by applying traction in a Thomas splint to the shortened leg The foot of the bed must be raised on blocks and the patient given only one pillow so that he will slide up the bed and so apply the necessary counter traction Traction should be maintained for six weeks.

Complicated fractures Both the bladder and the male urethra are liable to damage when the pelvis is fractured. The diagnosis and treatment of these conditions will be discussed in a later chapter but we may say here that every case of pelvic injury must be examined for a possible injury to the bladder or urethra

If the patient has successfully passed urine since the accident, and there is no blood in the urine, no serious damage has occurred. If he has not passed urine before he is seen he should not be asked to try to do so If there is a rupture of the urethra the urine will escape through the rupture and spread through the tissues if he urinates This is known as *extravasation* of urine.

If no urine has been passed the correct treatment is to pass a catheter If this enters the bladder and withdraws clear urine there will be no need to worry, but if the catheter either fails to enter the bladder or withdraws pure blood or blood-stained urine then the case must be treated as a surgical emergency A surgeon must immediately be called or the patient transported to a hospital.

If the patient has to travel a long way to hospital his bladder may be drained by inserting a lumbar puncture needle into the bladder from above the symphysis pubis and allowing the urine to drain into a bottle through rubber tubing This will avoid the danger of extravasation during the journey

CHAPTER 17

ARTHRITIS IN LOWER LIMB JOINTS

THE design of the joints of the lower limb is such that they not only permit movement to take place at the joint, but they are also strong enough to withstand the stresses which arise from weight bearing

Their ligaments are very strong and movement is limited to a very simple hinging or gliding movement in all except the hip joint. The cartilage covering the bones is thick, and the bones are so shaped that weight is widely spread over the joint surface in the normal standing position.

Despite the care with which the joints are made they are subjected to much more stress than upper limb joints and degenerate more quickly As they degenerate the range of movement decreases but this may not give rise to symptoms because the patient himself is growing older and does not expect the same mobility as in his youth

If degeneration occurs at an earlier age than it should, the patient does not restrict his activities in the same way as an older patient and the joint is subjected to repeated strains and stresses. The patient then complains of the pain and stiffness of *osteoarthritis* When this occurs, the joint must be protected from severe strains, but stiffness should be kept as slight as possible by gentle exercise. If pain is severe an arthrodesis of the joint may be required and the arthrodesis will be done with the joint in the position of function.

Early degeneration of a joint may have no obvious cause but it is definitely more liable to occur if a fracture has been treated in such a way that mal union causes a tilting of one of the joints so that weight is not borne on the part designed for weight bearing A shortening of up to one inch in the lower limb following a fracture, is not as important as an angulation which will put a strain on the joint.

Osteoarthritis will also follow damage to the joint-cartilage this may result from a fracture entering the joint and making the cartilage surface irregular or it may result from an inter

Inspection. The inspection may show swelling of the joint caused by thickening of the synovium or the presence of fluid.

The position of the joint must also be noted, and active movement can be tested at this stage by asking the patient to move the joint as far as possible.

Palpation will reveal any increase in local temperature, in comparison with the same joint of the other leg. Fluid may also be demonstrated by the presence of fluctuation, especially in the knee-joint.

Passive movement. If pain and spasm are not too severe, an attempt should be made to move the joint passively—that is without the assistance of the patient. It is often difficult to get the patient to relax his muscles sufficiently for this to be done but the amount of passive movement that can be obtained, and the directions in which it is limited, may be of great assistance in making a diagnosis. Passive movements must not be forced if they cause any pain.

TYPES OF ARTHRITIS

All types of arthritis are very much more common in the lower limb than in the upper limb.

Traumatic synovitis may follow a sprain and if it fails to respond to treatment, a fracture must be excluded by an X ray. Aspiration of the joint may reveal the presence of a haemarthrosis.

A *chronic traumatic synovitis* is extremely liable to develop in the knee-joint. It results from inadequate treatment of an injury whereby the quadriceps muscle is allowed to become wasted and the joint is weakened.

This condition must always be remembered. If it is not remembered a mistaken diagnosis of gonococcal, syphilitic or tuberculous arthritis may be made.

Acute septic arthritis. This may occur in any of the three major joints—the ankle, the knee and the hip.

The diagnosis will be suggested by a history of sudden onset, severe pain, limitation of active and passive movement, and toxaemia.

Chronic infective arthritis. The most common cause of chronic infective arthritis is *tuberculosis.* This is most common in the hip, then the knee, then the ankle and, finally, the tarsal joints.

The diagnosis will be suggested by a long history of steadily increasing pain loss of weight and low fever

Final diagnosis may not be possible until after the patient has been admitted for rest and observation

Osteoarthritis has already been discussed earlier in this chapter The patient has pain and limitation of movement, but there is no fever The X rays show a loss of the joint-space and the presence of osteophytes

The diagnosis will be made more probable if there is obvious deformity from the mal union of a fracture. Otherwise it is most likely to occur in elderly patients

THE ANKLE

All varieties of arthritis are less common in the ankle than in the knee or the hip The position of deformity which develops in chronic arthritis is usually one of equinus, and this must be corrected if good function is to be obtained. The foot must be kept at a right angle whether treatment is given by rest on a splint or in plaster of Paris Chronic deformity may have to be corrected under an anaesthetic either by manipulation or by an open operation.

Acute cases of traumatic, gonococcal or septic arthritis will normally respond to rest and treatment of the infecting organism, if infection is present.

Tuberculous infection usually results in bony ankylosis and this may be hastened by arthrodesis when the general toxaemia has been controlled.

Arthrodesis will also be the best treatment for persistent pain from osteoarthritis or for painful fibrous ankylosis following an acute infection or injury

THE KNEE

The knee joint is very subject to arthritis of all types We have already seen how readily traumatic arthritis may occur and how it may become chronic because of the weakness which develops in the quadriceps muscle.

Septic arthritis and gonococcal arthritis are also common, and if they do not respond to conservative treatment, a fibrous ankylosis develops which may require arthrodesis

If an acute septic arthritis appears to be present, careful examination followed by aspiration of the joint should be carried out in order to exclude an acute osteomyelitis of the lower end of the femur

Tuberculosis will require rest in the early stages in a Thomas splint or plaster of Paris. Osteoarthritis will require gentle exercises Both may require arthrodesis in the later stages.

Severe flexion deformity may be found in chronic cases and *this must be corrected. The correction may be done gradually if* there is no bony ankylosis The limb may be fixed to a splint of Cramer wire or a McIntyre splint, and this is gradually straightened out over the course of a number of days or weeks or the leg may be encased in plaster of Paris. The plaster is divided behind the knee and the knee straightened slightly The procedure is repeated as often as is necessary until the leg is straight. If bony ankylosis is present, the bone will have to be divided by an osteotomy before the leg can be straightened

In the early stages of the treatment of an acute infective arthritis, the knee is kept at rest in bed by traction on a Thomas splint in convalescent cases, rest may be continued by a walking plaster from the groin to the toes or in some cases, from the groin to just above the ankle.

THE HIP

There are three common varieties of arthritis of the hip which appear at different ages.

Septic arthritis

In infancy an acute septic arthritis may occur The head of the *femur lies wholly inside the joint* capsule, and it may be totally destroyed by the arthritis if the latter is not treated promptly with penicillin and the joint either aspirated or incised to *release the tension. If the femoral* head is not destroyed the result of a severe septic arthritis may be a fibrous or bony ankylosis this ankylosis will occur with the limb in a deformed position if the case *has not been treated* by traction

When traction has not been applied the psoas muscle draws the limb into flexion and adduction traction on the limb automatically *corrects this pull on the psoas* and holds the leg in slight

abduction. The traction is obtained by adhesive strapping which is applied to the infant's leg and then tied to the end of the bed, the leg may be left lying on the cot or in older children, it may be placed in a Thomas splint. The foot of the bed is, of course, raised

If the head of the femur has been totally destroyed the femur will rise up towards the gluteal region, with shortening of the limb and the development of a severe limp This deformity is very difficult to correct.

Tuberculosis

Tuberculosis of the hip is most common in young adults The patient has pain in the hip and walks with a slight limp In some cases the pain is referred down to the knee.

Pain is caused by movement of the hip in *all* directions This is important in examination, as a mistake is often made in diagnosis. One common cause for a mistaken diagnosis is a deep inguinal adenitis The reason for this is that the psoas muscle is irritated by the chronic lymphadenitis of the deep inguinal glands, and it then goes into spasm and causes a deformity of the hip In these cases it will be found that the hip may be rotated freely after it has been flexed to relax the psoas there is also a tender mass of glands in the abdomen just above the inguinal ligament. These cases respond very well to the local application of a kaolin poultice, rest in bed, and penicillin.

In tuberculosis *all* movements of the hip cause pain, whether they are flexion, extension abduction, adduction or rotation. In early cases the swelling of the joint may cause a slight abduction deformity but in later cases the usual deformity of adduction and flexion develops.

Treatment is by rest, streptomycin and isonicotinic acid (isoniazid) African patients recover fairly quickly and it has been found that traction in a Thomas splint provides sufficient rest for most cases. Fibrous or bony ankylosis usually occurs within a year and this may be hastened by arthrodesis once the general toxaemia is controlled.

Osteoarthritis

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Osteoarthritis

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structed not to injure the joint further by too vigorous exercise, and also not to allow the joint to become too stiff by resting it too thoroughly

In severe cases pain is more constant, and a flexion adduction deformity develops Physiotherapy may be of great help by providing heat to the joint and by giving exercises that encourage correction of the deformity and increase the range of movement.

If the case is very severe it may have to be treated by arthrodesis. Sometimes both hips are affected, and treatment is then difficult, since it is crippling for a patient to have both hips arthrodesed. In these cases it is possible to remove the head of the *femur and replace it with a model of the head made of steel* or of hard plastic. The model head is fixed on to the shaft of the femur by a spike of stainless steel Yet other cases may be relieved by an osteotomy of the femur to correct the deformity

CHAPTER 18

OTHER LESIONS OF THE LOWER LIMB

CONGENITAL ABNORMALITIES

EXTRA toes and double toes may occur and congenital webbing may also be seen. Extra toes should be excised soon after birth, but minor degrees of doubling of the toes or webbing require no treatment, because the toes do not require the free, independent movement that fingers need. Operative treatment will only be necessary if the deformity is causing difficulty in walking or if it is obviously unsightly

Congenital talipes equino-varus (club-foot)

This abnormality is not uncommon, as it appears in a severe degree in about one in every thousand births. The child s foot is twisted downwards and inwards until the sole of the foot faces the opposite foot frequently the condition is present on both sides, so that the soles face each other The exact cause is unknown

The sooner treatment is started, the better If the baby is referred to a surgeon when it is only one week or ten days old the chance of complete correction is very good. A light aluminium splint is used which will hold the feet in good position while the child is allowed to kick its legs and develop its muscles. At this stage correction of the deformity is fairly easy Full correction is probable within three months if the feet are strapped to the splint in a better and better position every week.

The longer the child is left before treatment is started, the more difficult does correction become. The aluminium splints may still be used if the child is not seen until it is six months old, but treatment may have to be continued for five or six months before the feet will stay in their proper position.

If the child is over six months old when it is first seen, correction may be obtained by manipulation and repeated changes of

plaster of Paris, but if the child has been left for a number of years the only possible correction will be by operation.

Congenital dislocation of the hip

Some children are born with a very shallow acetabulum. In these cases the head of the femur easily slips out of position. It is probable that in most cases the neck of the femur is also deformed. The disability is uncommon, and it is not often noticed until after the child begins to walk. It is then noticed that the child has a limp, and an X ray will show the dislocation. Treatment should be begun as soon as the diagnosis is made it may be possible to get normal development if the dislocation is reduced and the leg splinted in flexion and abduction for six months or a year

A neglected case will require open operation, but, even with operation, results are not good and there is a probability that the patient will develop osteoarthritis between the ages of twenty and thirty Fortunately the deformity is rare among races who carry their children on their backs or hips with the infant's hips flexed and abducted the author has only seen one case in an African during seventeen years in East Africa.

SOFT TISSUE INFECTIONS

Chigoe infection of the toes Madura foot, tropical ulcer tropical myositis and the effects of filarial infection leading to elephantiasis, *are common in the lower limb* They have all been dealt with in Part One of this book to which reference should be made.

OSTEOMYELITIS

The lower limb is the most common site for the development of acute and chronic osteomyelitis *It is found most frequently in* the lower end of the femur but the second most common site is the upper end of the tibia. Both these sites are close to the knee-*joint there will often be an effusion into the joint*, and the case may be mistaken for an acute septic arthritis if the examination is not carefully made. An aspiration of the joint will be helpful in difficult cases, as a septic arthritis will have pus in the joint while an effusion secondary to osteomyelitis will be clear

MALIGNANT TUMOURS

Epithelioma

The most common malignant tumour in the lower limb is an epithelioma secondary to at ropical ulcer The ulcer will probably have healed in the past by scar tissue and a thin covering of epithelium which has grown over from the edges.

The epithelium is very thin and is easily damaged, so that a fresh ulcer develops. Each time this occurs, the scar tissue under the ulcer becomes more and more dense, so that healing becomes more and more difficult until a chronic ulcer develops. The epithelium round the edges of the ulcer continues to try to grow over the surface, and it becomes more and more active in its efforts until it may eventually turn malignant.

The best preventive measure is the treatment proper to all tropical ulcers, that is, covering all extensive ulcers with skin-grafts. Before a skin-graft can be applied to a chronic ulcer, all the dense scar tissue must first be excised so that the graft can be applied to tissue which has a good blood supply

A malignant ulcer is suspected if the epithelial edges are thick and the surface of the ulcer is rough. A syphilitic or yaws ulcer sometimes looks very similar, and if the diagnosis is in doubt a portion of the ulcer should be excised for pathological examination. The removal of a piece of living tissue for this purpose is known as a *biopsy*

An epithelioma usually grows slowly and takes quite a long time to spread by invasion of the lymphatics. If the diagnosis is made early a good result may be obtained by simple local excision but if the bone has been invaded an amputation will be necessary If the inguinal glands are also affected they should be excised, but by then it is probably too late to be able to ensure a cure. Enlargement of the inguinal glands does not mean necessarily that they have been invaded by malignant cells they may be enlarged because of chronic pyogenic infection. Only the pathologist will be able to tell the cause of the enlargement.

The slow growth of the epithelioma suggests that it is composed of cells which are very similar to normal skin-cells and not to primitive cells. Radium might be used for treatment, but it would have to be used in a dosage which would seriously risk damage to surrounding normal cells it is therefore not recommended.

Sarcoma of bone

Osteogenic sarcoma appears in young adults and when it does occur it frequently affects the lower end of the femur It is very malignant and soon gives rise to a hot, painful swelling which may be mistaken for osteomyelitis. An X ray is usually very helpful in making the diagnosis.

The treatment is amputation as soon as the diagnosis is made, but the tumour is so malignant that the chances of survival are very small. Fortunately the tumour is not common.

NERVE LESIONS

Injury

Injury to nerves is less common in the lower limb than the upper The femoral nerve supplies the quadriceps muscles high up in the thigh the obturator nerve supplies the adductor muscles and is well protected by muscle and bone the sciatic nerve, the most important nerve of the limb, supplies all the muscles and most of the skin below the knee, as well as the muscles on the back of the thigh However, it is also well protected by muscles for most of its course.

Sciatic nerve injury

(*a*) *Injury to the roots* The roots of the sciatic nerve may be pressed upon by the pulpy nucleus of an intervertebral disc when degeneration has led to the prolapse of the nucleus pulposus The nerve may be pressed on sufficiently to cause the pain and disability of sciatica, or there may be sufficiently severe pressure for actual paralysis to take place.

In sciatica the patient suffers from pain in the lower lumbar region and down the back of the leg along the course of the nerve. The pain is made worse if the nerve is stretched by raising the leg from the bed with the knee straight, and the pain becomes even more severe if the stretching is increased by then dorsi flexing the foot. If paralysis is present, there may be loss of sensation round the outer side of the heel and foot, loss of the ankle jerk, and possibly a foot-drop from paralysis of the tibialis anterior

In mild cases the condition will recover fully if the patient is confined to bed completely for three or four weeks Persistent mild pain should be treated by placing the spine in a plaster

jacket, while persistent severe pain or paralysis should be treated by an operation on the spine to remove the prolapsed portion of disc tissue.

(*b*) *Injury of the sciatic nerve in the thigh* The sciatic nerve is rarely injured in the thigh in peace time, although it may be severely damaged by bullet wounds in war time Very occasionally it may be bruised by the head of the femur at the time of a dislocation of the hip

If the resulting paralysis is incomplete, it is probable that full recovery will occur but if there is any chance that the nerve has been completely divided by a bullet or by a blow from a weapon, then the nerve should be explored at once. The nerve-axons have such a long distance to grow that it is not safe to allow any delay after a complete division before suture is carried out.

(*c*) *Injury close to the knee* Just above and behind the knee the sciatic nerve divides into medial and lateral popliteal branches. The lateral popliteal nerve passes downwards and laterally, and then winds round the neck of the fibula.

Behind the knee-joint, and as it winds round the fibula, this nerve lies close under the skin and is very liable to damage. The nerve supplies all the peroneal muscles and all the extensor muscles of the ankle and foot, so that damage will result in a foot drop

The results of repair of the peroneal nerve are not very good, and if they fail, the patient must be given some other means of overcoming his disability Either he may be provided with boots and a walking-caliper or the ankle-joint may be arthrodesed.

Leprosy

Leprosy may involve the lateral popliteal nerve at the knee or the anterior tibial nerve close to the ankle. The most common disability is a foot-drop and this is best treated by an arthrodesis below the ankle.

Poliomyelitis

The lower limb is more frequently involved in poliomyelitis than any other part of the body There may be a total paralysis of the whole lower limb which will of course, be confined solely to the muscles, with no sensory loss Alternatively there may be a partial paralysis involving some muscles more than others

In the early stages treatment will be directed to maintaining the mobility of joints, preventing deformity, and re-educating the muscles.

In the late stages surgical treatment will be required in order to give the patient as much function as possible. The chief function of the lower limb is to bear weight, and the second function is to move the limb, therefore a stiff, stable joint is more important than a loose one that cannot bear weight.

In mild cases a number of tendon transplants can be carried out, especially to strengthen the ankle, but if no strong muscles are available round the ankle it may be necessary for the patient to wear a caliper permanently The patient may be able to discard his caliper if the foot is made more stable by arthrodesis of the joint below the ankle. Arthrodesis will not be carried out until the child is twelve or fourteen years old until then a walking caliper will be necessary

In the region of the knee paralysis of the quadriceps gives rise to most cases of disability It is not wise to arthrodese a knee for poliomyelitic paralysis, because the bones are usually weak from disuse and a fracture may easily occur in the very long bone which is made from the femur and the tibia by arthrodesis. The knee is best protected by a caliper that passes from the top of the thigh down to the heel of a boot. A caliper is particularly important in childhood, in order to prevent deformity of the knee, either in hyper-extension or in valgus deformity

When the whole leg has been paralysed, the ankle may be arthrodesed, a caliper provided for the knee, and the patient given crutches to allow him to walk despite paralysis of the hip If only one leg is affected the patient may learn to walk by trick movements of the hip and be able to do without crutches.

Paraplegia

A paraplegia is a total paralysis of the motor and sensory nerves of both lower limbs.

Extensive paralysis of the skin and muscle may occur in the lower limbs following fractures of the spine The injury may be due to damage to the spinal cord or the roots of the nerves as they pass down the canal after leaving the cord If only the nerves have been damaged there is some chance of recovery but recovery is very rare after cord damage

Paraplegia may also follow pressure on the cord as a result of tuberculosis of the spine.

These conditions are dealt with more fully in the next two chapters.

LESIONS OF BLOOD-VESSELS

Injury

The collateral blood circulation round the knee is even poorer than it is round the elbow As a result, division of the lower end of the femoral artery or of the popliteal artery may deprive the lower part of the leg of its blood supply with resulting gangrene In these cases amputation will be required through the thigh, but as much of the length of the limb should be left as possible

The arterial supply of the limb may not be divided but it may be compressed by the pressure of oedema and haematoma formation within the limb, especially if a fracture has been treated by a skin tight plaster a few hours after injury Severe interruption of the blood supply will result in gangrene, which will be shown by lack of circulation in the toes followed by blackening of the skin The circulation may be tested by pressure on a toe-nail, and then by watching for the return of circulation on release of the pressure.

Less severe interruption to the blood supply will result in an ischaemic necrosis of the calf muscles with the result that an equinus deformity may develop If a collateral circulation does develop it may be sufficient to prevent gangrene or severe ischaemic contracture but the circulation may not be sufficient to provide the calf muscles with adequate blood during exercise. The patient will then complain of severe pain in the calf when he walks a moderate distance, and he will have to rest until the pain subsides.

No fracture should be treated by a skin tight plaster unless the plaster is split from one end to the other the foot of the bed must be raised on blocks to reduce oedema and the toes must be exercised. The limb may be padded with wool before the plaster is applied, but there is a danger if this method is used, of displacement of the fracture within the plaster when the swelling subsides.

If the limb has been completely enclosed in plaster and there is evidence of a poor circulation to the toes, the plaster must be

PART THREE

REGIONAL SURGERY—SPINE, HEAD AND NECK

CHAPTER 19

INJURIES OF THE SPINE

ANATOMY

THE spine extends from the base of the skull to the tip of the coccyx. It is composed of thirty two vertebrae whose bodies lie on top of one another separated by the intervertebral discs from the back of the bodies a ring of bone is formed which encloses the central nervous system. The bodies themselves lie deep inside the back of the patient so deep in fact, that they may be felt anteriorly through the abdomen of a thin subject.

The lowest three vertebrae form the coccyx, which corresponds to the base of the tail of other animals Injury to the coccyx is rare and need not concern us further

The next five vertebrae are fused to form the sacrum. As they are fused together they form a solid block of bone which is rarely fractured. If a fracture does occur displacement is slight and union readily occurs with little disability

Above the *sacrum lie the remaining twenty four mobile* vertebrae, five lumbar twelve thoracic and seven cervical. These are the vertebrae which are most subject to injury and disease.

Injury may be complicated by damage to the central nervous system and to the main nerves that arise from the spinal cord. In this connexion it is important to remember that the spinal cord ends opposite the level of the second lumbar vertebra all the lumbar nerves and most of the sacral nerves are given off from the cord above this level, and they travel down bunched together in the spinal canal until they reach their own vertebrae —the first lumbar nerve leaving the spine below the first lumbar vertebra and so on.

The result of this arrangement is that, in a complicated fracture of the spine, the cord itself may not be damaged but only the spinal nerves The spinal nerves have a chance of recovery, but there is no chance of recovery if the cord itself has been damaged.

The thoracic spine is relatively rigid as movement is limited by the attachment of the thoracic cage formed of the ribs and sternum. The really mobile parts of the spine are the lumbar and cervical regions and injury is more common here than in the thoracic region—quite the commonest site for a fracture of the spine is at the junction of the mobile lumbar spine with the less mobile thoracic spine, that is from the eleventh thoracic vertebra to the second lumbar

FRACTURES OF THE LUMBAR SPINE AND THE *THORACO LUMBAR JUNCTION*

The most common cause of fracture of the spine in this region is a compression of the vertebral column from above downwards. If a person falls from a height he may land on his feet or on his buttocks The weight of the rest of his body carries on down wards and the body is usually flexed forwards at the same time. Alternatively the patient may be sitting or standing with his head bent forward, when a heavy weight, such as the wall or roof of a house lands on his shoulders, crushing the spine forwards and downwards

The vertebral bodies are not strong enough to withstand this sudden compression and one or more of them may collapse.

If the collapse of the body of a vertebra is the only injury that has been received the condition is not serious The patient has suffered a *simple compression fracture of the vertebra* In the course of the next three months the fracture will unite and although the slight deformity will persist, there will be no disability so long as efficient treatment has been given.

In these mild compressions, the patient should be put to bed for two to three weeks in order to allow the bruised soft parts to recover from the injury He is then taught muscle exercises in order to strengthen the muscles lying behind the spine. After another week he is allowed to get up but he must carry on with the muscle-strengthening exercises He must constantly try to extend his back and avoid flexing it. If this treatment is properly carried out, the fractured bone will suffer no further

damage, and, at the end of three months from the time of injury, the patient will be fit for the hardest labour A plaster jacket is quite unnecessary for these cases, in fact it simply gives rise to increased stiffness.

Unstable compression fractures of the spine

These fractures are caused by similar, but more severe, injuries to the spine. Not only is the body of a vertebra crushed by the compression, but the forward flexion of the spine is sufficiently severe to tear the muscles and ligaments at the posterior part of the spine, behind the spinal cord These injuries may be demonstrated by taking an X ray with the spine slightly flexed forward, i.e in flexion', the spinous processes will then be seen to be separated or fractures may be seen in the posterior bony ring An X ray, however, must never be taken in flexion if there is any sign of damage to the cord

These cases will not heal well with simple exercises The deformity must be corrected by hyper-extension of the spine and the application of a plaster jacket.

A plaster jacket must extend anteriorly from the top of the sternum to the symphysis pubis, in order to prevent any flexion of the spine, which would give rise to a recurrence of the deformity The plaster need not be nearly as extensive posteriorly In order to get the full length of the plaster in front, and in order to correct the deformity, the patient is turned on his face and allowed to hang between two tables. He rests his head and arms on one table, leaving the whole of the sternum clear and rests his thighs on the other table, leaving the whole pelvis clear It is advisable to give the patient a full dose of morphine before reduction and the application of plaster but a general anaesthetic is not required.

The plaster is worn for three months, during which time the patient is allowed to get up and walk about. He is also given exercises to strengthen the posterior spinal muscles inside the plaster

After the plaster has been removed, exercises are continued in order to increase further the strength of the muscles and to restore the power of flexion to the spine.

Treatment, after removal of the plaster may have to be continued for a further three months and, even then, some patients will have persistent back-ache. For this reason it is now strongly recommended that all cases of unstable fracture of the spine

should be treated by immediate arthrodesis of the spine. Arthrodesis will prevent any movement of the spine in the region of the fracture, and pain cannot then develop The patient will have to lie in a plaster bed for four months after an arthrodesis.

Fracture-dislocation of the lumbar or lower thoracic spine

When the compression force is even heavier, and especially if it has been combined with a twisting force, the injury may be severe enough to cause complete separation of one vertebra from the one below, so that the upper vertebra slides forwards and is twisted to one side. It is in these cases that the spinal cord or the spinal nerves may be damaged.

If there is no nerve damage, the case will be treated in the same manner as an unstable compression fracture, by reduction and either a plaster jacket or arthrodesis

When the nerves or cord are damaged this complication requires more urgent treatment than the bony injury

Injury to the spinal cord or spinal nerves may be complete or incomplete, no recovery may be expected from damage to the cord, but there is a good chance of some recovery from nerve damage. If the fracture is about the level of the thoraco-lumbar junction the cord may be divided, giving a permanent paralysis of the sacral nerves, but the lumbar nerve roots which lie along side may be only bruised and may recover so that some power can return to the lower limbs

Recovery will only occur if the case is very carefully treated in order to avoid further damage to the nerves and to relieve any pressure that is present.

A fracture-dislocation of the spine with nerve damage will be diagnosed by the presence of spinal injury flexion deformity of the spine and retention of urine the condition will be even more obvious if there is also motor and sensory paralysis in the lower limbs A combined motor and sensory paralysis of the lower limbs is known as a *paraplegia.*

As we have stated there may be a chance of some recovery so long as further damage is not inflicted on the nervous system. For this reason every effort must be made to prevent any movement taking place at the site of the fracture especially any flexion whatever of the spine must be avoided. The spine must be kept as still as possible during first aid treatment, during transport from the ambulance to the out patient department

from there to the ward or to the X ray department and during the actual X-ray examination It is best to turn the patient on his face and then lift him by the chest and the pelvis in order to extend the spine and, when the patient is turned, he must be turned in one piece'

After examination further movement of the spine may be prevented by placing the patient in a plaster bed until the fracture has united. During this treatment the paralysis of the bladder can also be given attention, as outlined below, but it is very difficult to take care of the skin of the lower part of the body or to move the joints of the lower limb to prevent stiffness

It is unfortunately true that a large number of patients who are treated in this manner eventually leave their plaster beds with a chronically infected bladder, pressure sores of the skin in the regions of the sacrum, the trochanters and the heels, and very stiff joints in the lower limbs The after-care of these cases is extremely difficult and they often lie in hospital for a few months or years until they eventually die of urinary infection

Emergency operative treatment

Recent advances have very much altered this outlook, if facilities for emergency operative treatment are available.

For this treatment the patient is taken to the operating theatre as an emergency He is anaesthetized and carefully turned on his face the fracture-dislocation is then reduced as much as possible, in order to remove pressure from the spinal nerves An incision is made along the spine in the region of the fracture, and the posterior spinous processes are held together by stainless steel plates which are either screwed or bolted on on either side of the spinal processes.

The purpose of this internal fixation is twofold. First of all it will prevent further movement and further damage at the fracture site. Even more important, it will allow the patient to be turned about in bed.

Where major surgical facilities are not available, better results will always be obtained by careful turning and nursing as outlined below rather than by placing the patient in a plaster bed.

Care of the skin

The important cause of bed sores pressure sores, and plaster sores, is prolonged pressure on the skin, especially in the presence

of recent paralysis. Prolonged pressure reduces the blood supply to the area of skin which is compressed this is followed by thrombosis in the capillaries and death, or necrosis, of the skin. This is even more likely to occur in the first three weeks after a paraplegia, because the blood-vessels are also paralysed and there is stasis of the blood. After about three weeks the blood vessel tone usually returns and the danger becomes less—but it does not disappear completely, because the skin is insensitive and the patient feels no discomfort from prolonged pressure. In undernourished patients, the risk of pressure sores will be greater still.

In a normal person, prolonged pressure on one point is avoided by constant small movements of the body, or even by turning right over while he is asleep The only way to avoid pressure sores is to imitate this natural process hardening the skin with spirit and dusting it with powder will help but will not definitely prevent sores Sores can only be prevented by moving the patient into a fresh position every two hours This should be done in the case of every post-operative patient, every unconscious patient, and every patient suffering from paraplegia.

If the spinal fracture has been fixed with metal plates the patient can be turned without fear of further damage to the spine or cord

Care of the joints

The patient will have to remain in bed for three months while he is waiting for the fracture of the spine to unite. While he is lying in bed in this way the skin must be looked after but the joints of the limbs also must be cared for If they are left alone they will become stiff They must be moved through their *full* range of movement every day Movement through just a part of the range is not sufficient full flexion, extension abduction and adduction are required.

Care of the bladder

Paralysis of the bladder results in retention of urine which requires immediate relief If the bladder is properly looked after and infection is prevented, a condition known as an automatic bladder will develop in three weeks to two months In this condition the bladder slowly fills and when it reaches a

certain state of fullness, it automatically empties It may also discharge urine if pressed on by the patient.

The best method of taking care of the paralysed bladder in the early stages is to pass a catheter, fix it in the bladder and drain it to a bottle. 200,000 to 400,000 units of penicillin are given daily and the bladder is washed out twice a day The wash-outs must be very carefully done with a large bladder- or ear-syringe. 1/10 000 acriflavine in water is used, six to eight ounces are injected slowly to stretch the bladder, and the fluid is then aspirated out again with the syringe The aspiration must be continued until the bladder is absolutely empty Complete emptying is necessary in order to avoid leaving behind a small pool of infected urine the emptying will also help to restore the tone of the bladder

After three weeks the catheter may be removed and attempts made to encourage the bladder to empty itself by gentle pressure on it above the symphysis pubis If the bladder fails to empty the catheter must be reinserted and continuous drainage and wash-outs repeated for a further week. Trials of removal of the catheter can be made every week until an automatic bladder has developed.

Sometimes the bladder will become infected by penicillin-resistant organisms. This will be shown by pus in the urine and a rising temperature. In these cases the urine should be cultured and the pathologist asked to state what antibiotic he recommends for the organisms present

Care of the bowel

In cases of paraplegia the bowel is paralysed as well as the bladder The diet must be carefully regulated to prevent either constipation or diarrhoea, and purgatives or enemata are given as necessary Liquid paraffin should not be given, as the anal sphincter is paralysed and there will be a tendency for the paraffin to leak out into the bed.

Late treatment

If skin, joints bladder and bowel have all been properly cared for the patient will be ready for further treatment in three months from the date of injury

By this time the spinal injury has healed and some muscle power will have returned to the lower limbs *if it is going to return at all* Unfortunately, in most cases, there will be permanent paralysis of the lower limbs as well as the bladder

The muscles of the upper limbs and trunk can be strengthened by physiotherapy, the joints of the foot can be arthrodesed, and the patient supplied with boots and calipers to control the paralysed knee-joints

The final state of a patient's recovery should be ability to walk with the aid of crutches and calipers and to retain his urine for several hours at a time.

Summary

There are three main varieties of fracture of the lumbar spine

(*a*) Stable fractures involving only a minor crush of the body which are best treated by exercises

(*b*) Unstable fractures, without nerve damage, which should be treated by arthrodesis or in a plaster jacket.

(*c*) Fractures with nerve damage which should be treated by metallic fixation of the spine, great care must be taken of the skin, joints, bladder and bowel

Finally one must never forget to examine the whole patient on admission in order to exclude injuries elsewhere, remembering especially the possibility of a fracture of the calcaneus

FRACTURES OF THE THORACIC SPINE

The thoracic spine is injured comparatively rarely The normal movements of the spine in this area are slight movements constantly repeated during respiration and during rotation of the spine while the patient is turning round, the range of normal flexion or extension is very small As a result, this area is comparatively well protected against compression injuries.

The most common cause of fracture is a heavy weight which lands on the patient's shoulders causing a mild compression fracture of one or more vertebral bodies.

Nerve injury is unlikely and the majority of cases can be treated by spinal exercises to strengthen the posterior muscles and hold the back straight.

FRACTURES OF THE CERVICAL SPINE

The cervical spine is the most mobile portion of the spinal column, where movement occurs freely in every direction

If a person falls from a height and lands on his feet or buttocks it is unlikely that the cervical spine will be damaged, because there is only the weight of the head above it, a fracture caused by such an accident usually occurs at the thoraco-lumbar junction. If, however, the patient falls on his head, and the neck is acutely flexed forwards a compression fracture or a fracture-dislocation of the cervical vertebrae may easily follow

A severe injury gives rise to a fracture-dislocation with nerve injury especially if there is a certain amount of twisting of the neck at the same time. A blow on the side of the head, on the other hand, will probably not cause a fracture or a dislocation but may cause a traction injury to the roots of the brachial plexus (see Chapter 14)

A simple compression injury is very much less common than a similar injury in the thoraco-lumbar region Owing to its free mobility however the neck may be injured in another manner In this case the head has been either forced violently forwards by a blow on the back of the head or it has been thrown forwards by its own momentum when a motor-car is involved in an accident and stops suddenly The patient s body stops moving forwards when the car stops, but the head carries on with the result that the patient develops either a sprain of the neck, a subluxation of a cervical joint, a dislocation of the neck, or a fracture-dislocation of the cervical vertebrae.

If the cause has been a blow on the head, the patient may also suffer from a head injury If the accident occurred while he was in a car he may also have a fracture of the patella or femur or a dislocation of the hip through striking his knees against the dash board or an injury to the chest through striking the steering-wheel.

Simple compression fracture

The rare, very mild compression fracture simply requires rest until pain has subsided, and then neck exercises will be prescribed. More severe compression fractures will be accompanied by some forward subluxation this may only be shown on an X-ray if a lateral view of the spine is taken with the head flexed forwards

Subluxation of the cervical spine

Subluxation is frequently accompanied by irritation of the nerve-roots of the cervical plexus with tingling in the arms. This may occur at once or may not develop for some months

Because of the risk of injury to the nerve roots, a subluxation must be treated seriously The displacement is reduced by extension of the neck, which is then fixed in plaster of Paris. In order to obtain complete fixation the plaster must include the whole of the chest and the head, and give firm support under the chin. The only parts that are left are holes for the arms and a ring round the face The forehead must be included in order to keep the neck extended.

The plaster must be worn for three months and thereafter the patient will require neck exercises to restore movement.

If full recovery does not occur an arthrodesis of the cervical spine will be indicated.

Dislocation and fracture-dislocation

The spinal cord is very thick in the cervical region and almost fills the spinal canal. The spinal nerves that leave the cord in this region pass out of the canal almost immediately instead of travelling down the canal for some distance as they do in the lumbar region. For these reasons, damage to nerve or cord is more likely than at the lower level and the cord is more likely to be damaged than the spinal nerves.

The result of a complete interruption of the cord is a paraplegia with total paralysis extending right down from the level of the injury If the cord has been divided above the eighth cervical vertebra, there will be paralysis of the whole trunk, lower limbs and the small muscles of the hand, breathing will only be possible by movement of the diaphragm. Above the fifth cervical vertebra there will be total paralysis of the upper limbs while above the third cervical vertebra the phrenic nerve will also be paralysed, and death will occur from paralysis of respiration

The spinal cord may escape damage at the time of the injury but it may be damaged later if treatment is not carefully carried out.

When a dislocation is present without nerve injury the patient must be carefully handled so as to prevent any movement

which might make the injury worse. The dislocation must be reduced and the neck fixed in plaster for three months Reduction may be possible by simple extension of the head, or it may require traction or even open operation. Traction is applied by straps under the chin and the back of the head which pass to a weight suspended over the head of the bed or by a special caliper, which is inserted in the bones of the skull. A weight of twenty to forty pounds may be required for reduction, and this cannot be applied comfortably to a strap under the chin.

When the dislocation is accompanied by total paralysis very little can be done for the patient. If he does not die of pneumonia, or septic absorption from pressure sores, or infection of the urinary tract, he will remain a permanently bed ridden invalid.

INJURIES TO THE INTERVERTEBRAL DISCS

The intervertebral discs are subject to relatively early degeneration (see Chapter 12). A sudden strain on a degenerated disc may cause the backward prolapse of the nucleus pulposus. This will press on the neighbouring spinal nerves and irritate them. The injury and prolapse is most often caused by a sudden bending movement or twisting movement and is more common in the lumbar and cervical regions than in the thoracic region.

Irritation of the cervical roots gives rise to brachial neuritis irritation of the sacral roots in the lumbar canal gives rise to lumbago or sciatica. The patient complains of pain in the back or neck, and the pain may also occur in the leg or arm. There may also be a complaint of tingling or even of numbness of part of the skin in the region of the nerve distribution. If motor fibres are also involved there will be weakness or paralysis of the small muscles of the hand or of the ankle.

The great majority of cases will recover if they are kept in bed with complete rest for three to four weeks. The application of a Thomas splint and traction to the leg is one of the best ways to keep an African patient in bed, and it is possible that this may also help to relieve pressure on the nerve roots in a case of sciatica. Similarly brachial neuritis may be relieved by traction on the neck with a head halter

If the patient shows *no* sign of recovery at the end of four weeks the spine should be opened and the portion of prolapsed nucleus

removed, if slight recovery has taken place, the rest in bed may be continued or the patient given a plaster jacket or some form of collar

After recovery from injury to the lumbar discs, the patient must be careful to avoid flexion of the spine and should be given exercises to strengthen the back muscles.

CHAPTER 20

DISEASES OF THE SPINE

THE spine is subject to very few diseases. Acute osteomyelitis occurs very occasionally, and so does bony infection by typhoid bacilli or the brucellae of undulant fever but by far the most common infection is from tuberculosis. If the spine becomes diseased one must think of tuberculosis first, but it is as well in the early stages to send a specimen of blood for agglutination, in order to exclude typhoid or brucellar infection.

Tumours also are rare. Primary tumours may occur in the spinal cord or meninges and give rise to signs of nerve paralysis which may be partial or total but they are very uncommon Secondary tumours are more frequently seen In this case an elderly patient complains of back-ache or of weakness of the lower limbs. An X ray of the spine then shows collapse of one of the vertebrae, due to a pathological fracture of one of the vertebrae The breast, prostate thyroid gland and kidneys should be examined for the primary tumour, but the condition is by this time incurable.

Anterior poliomyelitis is the most common disease of the spinal cord. The disease has been fully described in Chapter 9 Surgical interest is mainly directed to the treatment of residual paralysis in the limbs. (See Part Two)

Paralysis of the spinal muscles may however give rise to a deformity of the spine itself This usually takes the form of a scoliosis, or twisting of the spine. Mild cases require no treatment except for re-education of muscle more severe ones may require the support of a spinal jacket of metal and cloth or leather the most severe will require an arthrodesis of the spine.

TUBERCULOSIS OF THE SPINE

Tuberculosis of the spine is quite common. It occurs in the third stage of the disease, after the primary infection and after the stage of general spread of the disease. It may occur at any age, but it is most commonly seen in young adults. The disease

first appears in bone, close to joints and in this case the joints concerned are the intervertebral joints between the bodies of the vertebrae—and very occasionally the sacro iliac joints The sacrum, being one solid bone, is very rarely affected, but the cervical thoracic and lumbar spines are all liable to infection.

Pathology

The disease is characterized by local bone destruction, with very little reaction by the body in the early stages. There will be general toxaemia typical of tuberculosis and this will be shown by a loss of weight, a general appearance of ill health, a slight rise in temperature, especially in the evening and a rise in the erythrocyte sedimentation rate (E S R.) The measurement of the E S R. is a laboratory test. If the rate is raised it shows that infection of some kind is present, but it must not be relied on too much for assessing progress It must be remembered that the general appearance of the patient, and also the temperature chart, are just as important.

The local effects result from destruction of bone and the invasion of the joints. The slight pain which occurs causes stiffness of the spine due to spasm of the muscles in an effort to prevent movement. Actual bone destruction causes collapse of the vertebrae and the development of deformity

A backward projection of the spine is known as a *kyphosis* while a forward projection is known as a *lordosis* The thoracic spine has a normal kyphosis while the cervical and lumbar spines have a normal lordosis. Collapse of vertebral bodies will increase the kyphosis in the thoracic area and will diminish the lordosis in the other areas. Severe collapse of several neighbouring vertebrae will cause an acute kyphosis centred over the middle of the diseased area. Such an acute kyphosis is called a *gibbus*

Infection may also be accompanied by the formation of tuberculous pus. This will form a cold abscess which will expand out of the diseased area and gradually form a track as it grows along tissue planes between muscles and other structures Gravity will help a cold abscess to track downwards.

In unfavourable cases the infection will extend and spread and the general toxaemia will increase. On the other hand the body usually gets the upper hand and repair takes place. First

of all the general toxaemia subsides, then the local area of infection becomes surrounded by granulation and fibrous tissue and, finally, new bone is able to develop and ankylose the joints affected

Final repair by ankylosis will naturally be more rapid if the affected parts are kept at rest In East Africa it has been found that repair is more rapid in the local population than in Europeans, and the new bone appears earlier and soon becomes extensive and dense. Even so it takes at least a year after the beginning of the infection for full ankylosis to occur

Special sites

Cervical spine Tuberculosis of the cervical spine may occur in quite young infants. The cold abscess which develops tends to grow forwards and press on the back of the pharynx where it will give rise to obstruction to breathing and swallowing

Thoracic spine The thoracic spinal canal is very narrow and there is already a natural kyphosis present. Collapse of vertebrae is very soon noticed as a definite gibbus and tuberculous pus, granulation tissue or bone sequestra may project backwards from the bodies into the canal and press on the spinal cord. The cord may also be pressed on by inflammatory oedema. The motor tracts are first pressed on so that irritation of them first occurs followed by paralysis. This will be shown by an increasing difficulty in walking An increase in pressure may further damage the cord so that paralysis of the bladder and rectum follow, then comes sensory paralysis and complete paraplegia of the lower limbs.

A cold abscess may appear in the front of the thoracic vertebrae where it will be shown on an X-ray plate as a dense shadow on either side of the vertebrae The abscess may track from this site along the course of the intercostal vessels and nerves, and appear between the ribs round the side of the chest.

Treatment by rest is less easy in this site than in the cervical or lumbar areas, as constant movements occur between the vertebrae during respiration.

Lumbar spine In the lumbar spine, deformity is principally shown by a loss of the normal lumbar lordosis. An actual gibbus will only appear if there is very severe collapse.

The spinal canal is roomy and the cord and spinal nerves do

diseased vertebra when he sat up in his plaster bed The result of the fracture was a slight paraplegia.

The prognosis for recovery from toxaemia and for rapid consolidation of the local focus of disease is so good in Africans that very good results have been obtained by simply applying a plaster jacket. Where highly skilled nursing is not available, this method may be used in place of the usual frame or plaster bed.

The patient is instructed to remain in bed in his plaster jacket for the first phase of the disease, but, after general toxaemia has subsided, he is allowed to get up and walk about the ward, and is given spinal exercises to strengthen the posterior muscles

At the end of three months the jacket is removed an X ray is taken in order to check progress, and a fresh jacket is applied if there is no general toxaemia and there are good signs of bony consolidation the patient may be allowed to go home in his jacket for three months.

With this treatment the great majority of cases heal with the diseased vertebrae fixed in good position by bony ankylosis at the end of nine months or a year

More cases have still to be given anti tuberculous drugs before we shall know whether recovery may be hastened by this means. It is the author's practice to give all adult patients 50 mgm. of isonicotinic acid hydrazide (isoniazid) three times a day and 1 gm of streptomycin twice a week for the first thirteen weeks. In the occasional case which still shows general toxaemia, the course is continued for a further thirteen weeks. Children are given reduced dosages, according to their age.

Once the local area has been immobilized only a periodic check on progress will be required but it is most important to keep a constant watch on the general condition. The general condition is observed in three different ways. The first, and most important, is the general appearance of the patient the second is a carefully recorded temperature chart the third is a weekly recording of the erythrocyte sedimentation rate

If the general condition improves the patient can be given more freedom if it deteriorates he must be put back a stage.

Summary of treatment of an uncomplicated case

(1) Admit to complete rest in bed investigate tuberculin reaction Widal and Brucella agglutination E.S R. and temperature.

(2) Put the spine at rest by applying a plaster jacket, or fitting a plaster bed or special frame

(3) Give streptomycin and isoniazid for at least three months

(4) Keep a watch on the general condition, temperature chart and E S R.

(5) Change the plaster and take an X ray every three months until the local condition has healed.

TREATMENT OF COMPLICATIONS

Poor response to the normal treatment

A few cases fail to show a good response to the treatment outlined above. In these cases the area of the spine must be put at even more complete rest, and this is best done by fusing the posterior parts of the spine with a spinal bone-graft.

It must be remembered however that no operation should be done until the patient s general toxaemia is under control

Treatment of disease elsewhere

Disease in other parts of the body must be treated simultaneously This is not always easy and it will be the duty of the surgeon, often in co-operation with a physician, to decide which disease requires the more active treatment. Whatever the site of the disease, the patient must have both rest and anti tuberculous drug therapy

A tuberculous epididymitis is not uncommon and this may be treated by excision of the epididymis while the patient is still in a plaster jacket.

Cold abscesses

When cold abscesses come near to the skin they should be aspirated, the surgeon taking great care to pass the needle through healthy skin in order to avoid forming a sinus The need for repeated aspiration of an abscess that is pointing towards the back may prevent the immediate use of a plaster jacket in these cases a plaster bed will have to be used until pus is no longer forming

When an abscess has actually burst and formed a sinus the patient will require frequent dressings until the discharge diminishes

The presence of a sinus used to be a dreaded sign, as secondary

pyogenic infection was frequent the patient went rapidly down hill and often soon died.

Nowadays most sinuses can be dried up in a few weeks by giving penicillin for the secondary infection, and rest, plus streptomycin and isoniazid, for the tuberculous infection.

Paraplegia

The most common variety of paraplegia develops early in the disease and is due to oedema pressing on the cord, the backward pressure of granulation tissue or of a cold abscess within the thoracic spine or the backward pressure of a piece of sequestrated bone.

Mild cases will recover very rapidly if the spine is rested and the tuberculosis treated. If there is no response, or if the symptoms are severe the spinal canal should be opened and the pressure relieved. This should not, of course, be done until the patient has had a few weeks treatment, in order to control the worst of the toxaemia.

Occasionally a case is seen that has not been treated in the early stages Severe collapse of the vertebrae may have occurred, with the formation of a marked gibbus, but without the development of early paraplegia. The local disease eventually heals, but the severe deformity persists In these cases the spinal cord may be slowly stretched over the deformity, and it eventually becomes paralysed

The paralysis is then due to fibrosis within the cord, and there is often very little improvement if pressure is released

It may however be possible to prevent further deterioration and collapse by an operation designed to relieve the pressure and then fuse the spine by a spinal bone graft.

CHAPTER 21

INJURIES OF THE HEAD

SOFT TISSUE INJURIES

The skin of the scalp and face has an extremely rich blood-supply The result is that infection is rarely severe, provided that a wound is not stitched over dead infected tissue. Healing is also extremely rapid and stitches may be removed at the end of three to four days.

The free blood supply causes a rapid loss of blood from any wound, and the patient's appearance is often more alarming than the size of the wound warrants In the majority of cases bleeding is readily controlled by elevation and simple pressure.

The face

Cuts with sharp instruments can be stitched without excision of the wound edges, so long as they have occurred within the previous twelve hours after that period it is better to excise the wound before suture, but it is rarely necessary to leave the wound unstitched unless there is obvious infection.

If there is a cut right through the cheek it may be difficult to get good repair this is because the swollen tissue may become infected from the mouth. In these difficult cases the wound edge should be excised and the skin stitched to the mucous membrane this will leave a hole through the cheek into the mouth which can be repaired by a surgeon later

A blow from a blunt object may split the skin against the cheek bone, and in this case bruised tissue must be excised before the wound is sutured.

Another common variety of injury is a deep graze due to the face being scraped along the ground in a fall from a moving vehicle. These wounds should be carefully cleaned before they are dressed, and an endeavour made to remove small particles of road dirt. The cleansing will probably start fresh bleeding which can be controlled by gentle pressure with a swab A fine capillary ooze may persist for some time, and this can be stopped

by applying a thin wisp of cotton wool to the abrasion and then repeating gentle pressure with a swab The blood will clot within the wisp of cotton-wool which can then be left on as a dressing If desired, the cotton wool can first be slightly moistened with compound tincture of benzoin.

A common error is to take a fairly large piece of cotton wool, soak it with the tincture and apply it to the abrasion without first cleaning the wound Sepsis frequently develops under such a dressing

The scalp

Injuries to the scalp with blunt instruments are more common than with sharp ones. The scalp may be cut by a knife or a panga in a fight, but it is much more commonly split open by a blow from a stick or following a fall from a height or from a moving vehicle.

If a clean cut wound is gaping open, the underlying bone can be seen and inspected for the presence of a fracture. If no fracture is present the skin can be stitched without excision of the wound edges

In the majority of cases, especially if the injury has been caused by a blunt instrument, it is not possible to see the bone. A sterile probe may be inserted into the wound and, if a fracture is found, the case must be treated as a major surgical emergency If there is any doubt, the patient must be taken to the theatre and local anaesthetic injected round the wound. The edges of the wound can then be excised the wound opened up and the bone inspected

No case of cut scalp due to a blunt object should be stitched without first excising the wound and inspecting the bone using a local anaesthetic as a rule It is very important to exclude a fracture and it is also important to excise all bruised tissue If the scalp is stitched without these precautions infection may develop in the wound and pass into the skull by means of a minute crack fracture that could not be felt with a probe and will very often not be shown on an X ray plate. This infection can give rise to a fatal meningitis

FRACTURES

Mandible and maxilla

These fractures are frequently compound into the mouth and so they often become infected. They also involve the teeth which

may be loosened or displaced Some teeth may be knocked right out, others may become infected down to the their roots through the fracture line and others may be displaced with one of the broken parts of the mandible or maxilla.

A fracture will be suspected when a patient has had an injury to his face or jaw and he keeps his mouth a little open He is not able to shut his jaws properly, either because of pain or because the teeth are displaced

If a dental surgeon is available, he should be notified at once He will reduce the fracture and maintain the teeth in position by wiring them together or by using special splints attached to the teeth

Where no dental or other surgeon is available, a medical assistant must endeavour to obtain the best results he can. Any completely loose teeth should be removed, but all others should be preserved. They can be extracted later if they become infected at the roots. Obvious deformity is corrected and the jaws are held together by a bandage which passes over the head The bandage must be kept on and kept tight until the fracture has united.

Meanwhile the patient can take fluids only and must be fed from a feeding-cup A nourishing liquid diet must be prescribed. The mouth must be kept scrupulously clean by frequent mouth washes, which must be repeated after every meal. The mouth should be washed out with water under pressure. A Higginson syringe may be used for this purpose.

One serious complication of fractures of the mandible must be guarded against. If the jaw is broken it may move backwards, moving the tongue with it. The back of the tongue then occludes the throat, the patient is unable to breathe and dies of suffocation.

In any accident case where the jaw is involved the patient must be turned almost on to his face as soon as he is seen, so that the jaw will fall forwards. This is even more important in an unconscious patient, whatever the cause, since the position will allow blood to flow out of the mouth and prevent it from being aspirated into the lungs.

A first aid bandage must *never* pass from the point of the chin to the back of the head, as this will only press the jaw further back and increase the danger The best bandage for a jaw is a barrel bandage. This is passed from underneath the jaw to the top of the head where a single knot is tied. The knot is then

opened out so that half of it passes to the forehead and half to the back of the head, and a half knot is present over each temple. The free ends of the half knots are brought over to the top of the head again and tied there.

Skull

The importance of a fracture of the skull does not lie in the injury to the bone but in the injury to the underlying brain or the risk of infection within the skull.

The most common type of fracture is in a straight line, or fissure This may be confined to the vault of the skull or pass into the base. A severe blow with a blunt object may depress a fragment of bone into the inside of the skull and possibly into the brain, and this depressed fracture may of course, be compound.

Compound fractures must be treated as major surgical emergencies The skin and soft tissue wound must be carefully excised and the fracture of the bone inspected. If the fracture is simply a fine fissure, the skin may be stitched penicillin prescribed and the patient carefully watched

If there is any depression of bone the operation must be more extensive a hole is made in healthy bone near by and the edge of the hole is carefully enlarged until it reaches the fracture the depressed portions of bone can then be lifted out and the dura mater inspected. When there has been a tear of the dura the operation must be extended more deeply in order to remove all bruised brain tissue. Bruised brain tissue can be removed by a sucker after the tissue has been loosened by a stream of normal saline from an infusion bottle.

A conscious patient can be treated in this way under a local anaesthetic, a completely unconscious patient will need no anaesthetic at all while a restless, semi unconscious patient will require a general anaesthetic.

After completing the exploration and cleaning of the wound the scalp is stitched in two layers in order to reduce the chance of infection entering through the wound from the skin For the same reason it is better not to put a drain in unless there is a quite considerable oozing of blood

Simple fractures that is closed fractures are not submitted to urgent operative treatment unless there are indications for

operation as a result of brain damage. If there is no evidence of brain damage, a simple fissure fracture can be ignored, and the patient can be allowed to leave hospital as soon as there is no danger of any complication (that is after he has been under observation for at least twenty four hours) A closed depressed fracture, unless the depression is extremely slight, should be submitted to deliberate operation designed to raise the depressed portion of bone.

All cases of closed fracture must be admitted to hospital for twenty four hours for observation however well they may seem because of the risk that slow internal haemorrhage may cause compression of the brain. They must *not* be given morphine, as this may mask the onset of serious symptoms and may depress respiration dangerously Restlessness is a sign of brain damage, and its treatment is mentioned below Simple headache can be treated by aspirin or aspirin phenacetin-caffeine (A.P C) tablets

INJURY TO THE BRAIN

There are two important forms of brain injury The first is the effect of compression of the brain from outside The second is the effect of injury to the brain tissue itself

Cerebral compression

Slight compression of the brain may occur as a result of a depressed fracture—this has already been referred to The more important form of cerebral compression arises from haemorrhage within the skull. The haemorrhage may occur on either side of the dura mater if outside, it is known as an extradural haemorrhage, and an extradural haematoma is formed if the bleeding is within the dura a subdural haemorrhage gives rise to a subdural haematoma.

An extradural haemorrhage arises from the dural vessels which enter the skull between the dura and the bone. The rupture of a dural, or meningeal vessel is usually caused by a fracture of the skull. Subdural haemorrhage results from injury to the vessels of the inner membranes especially the arachnoid membrane there may be no fracture of the skull, damage having occurred as the result of sudden movement of the brain within the skull when the head was thrown suddenly forwards or back-

wards or sideways Alternatively, the head and the body may be moving already as in a fall or when thrown from a vehicle, and the brain continues to move forwards inside the skull when the head strikes a hard object.

The diagnosis of cerebral compression is of very great importance, because an operation to relieve the pressure may save a patient's life.

Fractures of the base of the skull are particularly serious, because the meningeal vessels all enter at the base, and the vital centres of the brain lie close by The vital centres are the centres for respiration and cardiac action. A fracture of the base of the skull will be suspected if there is bleeding from the ears or nose.

In a fracture of the base there may be such severe extradural haemorrhage and brain damage that the patient is brought into hospital deeply unconscious, with a slow pulse and noisy stertorous breathing These patients have been so severely injured that treatment is of little avail and death commonly occurs within a few hours

The patients who can be saved by operation have quite a different history This is due to the fact that curable haemorrhage is slow but continuous and the signs of compression appear relatively gradually

The patient may be knocked unconscious as a result of the injury and he is brought into hospital either after he has recovered consciousness or while still lightly unconscious or semiconscious If the unconsciousness was due to mild brain concussion the patient should steadily improve if, however he has a bleeding vessel, outside or inside the dura, compression will slowly develop and the state of unconsciousness will become worse instead of better

The bleeding frequently takes place in the temporal area, and the parts of the brain pressed on will be the motor and sensory areas of the brain. As the pressure increases, the limb on the *opposite side becomes* weak and then paralysed

Pressure may also affect the oculo-motor nerve. Irritation will cause the pupil of the eye to contract, and further pressure will cause paralysis and dilatation of the pupil. Similar effects on the oculo-motor nerves and on the other motor nerves may be due to direct injury to the brain at the time of the accident, and not to compression The important thing to notice is not a

paralysis of a limb or a contracted or a dilated pupil, but a *change* in their state while under observation

During compression, the pulse will also be noticed changing becoming gradually slower, while the blood pressure may rise.

All cases of head injury where the patient has been unconscious even for a short time after the injury MUST be admitted to hospital for observation. An accurate record must be made of

the state of unconsciousness
the power of the limbs, and
the state of the pupils

Then every hour the pulse must be recorded, the pupils inspected, and the power of the limbs tested. In an unconscious patient, the limb power can be tested by pinching the skin and seeing whether the patient withdraws the limb one limb can be compared with the other

This hourly observation must be continued for twenty-four hours. During this period *no* morphine should be given. (Occasionally a surgeon may take the risk of ordering morphine if he is satisfied with the condition of the head injury but is worried about other injuries to the body)

If there *is any deterioration in the condition of the patient* a surgeon should be informed *at once* A delay of a few hours may be fatal.

Internal cerebral injury

Internal injury to the brain is very much more common than compression. It can roughly be divided into three degrees—concussion, cerebral irritation, and coma. Mild cases are probably due to a shaking up of the brain cells while the more severe are accompanied by minute haemorrhages in the brain We have already *noticed that severe coma may be due to brain* damage plus severe compression in a fracture of the base.

Diagnosis The patient will usually be brought in with a history of injury but other possible causes of unconsciousness must be remembered and excluded. The most common of these is alcoholic intoxication and one has to be very wary in such a case. A drunken person can have a fall and be knocked unconscious the fact that his breath smells of alcohol does not mean that that is the only cause of his unconscious state and so if there is any

possibility that a head injury may have occurred, he must be watched as carefully as any other case. Cases have been known of people who have been certified as drunk, transferred to a police station, and who have died there of cerebral compression.

Concussion This is the mildest degree of internal brain damage. It may last for only a few minutes or for an hour or two The patient must be admitted to hospital for observation for twenty four hours. When he becomes conscious he may be given aspirin or A.P C. tablets for headache, but no morphine. Any other injuries will, of course, receive attention, but if there are no serious sequelae he may be allowed home at the end of the twenty-four hours, and he will be able to resume work in a day or two

Some patients have persistent headache. They may have to remain off duty for a longer time, but they must not be allowed to worry unduly about their condition and must be encouraged to return to normal life as soon as possible.

Cerebral irritation. When the brain is more severely damaged, the patient becomes restless and irritable This state may last for only a few hours, or it may possibly last for several weeks The patient is not deeply unconscious and can be roused to take food, but for the first twenty four hours he must be carefully watched for the possible development of cerebral compression

No morphine is given. The restlessness and irritability are controlled by barbiturate drugs such as luminal or medinal, sodium gardenal can be given intramuscularly if drugs are refused by mouth. It will also help to reduce irritability if the patient is kept quiet in a darkened room, but once he is fully conscious he is apt to become more irritable if he is kept for a

less unconscious so that severely painful stimuli will cause him to move a little or he may be only semi-comatose easily roused but quickly slipping back to unconsciousness again

The most severely injured patients will die soon after admission to hospital—if they have not died before admission—but there is a good chance of recovery for those that survive for more than twelve hours so long as cerebral compression does not develop

In relatively mild cases the patients can be roused and fed, and they will rapidly pass through a stage of cerebral irritation to full consciousness.

The care of a deeply unconscious patient is most important

Care of the skin Bed-sores must be avoided by turning the patient to a different position every four hours and making sure that he is not allowed to lie in a wet bed.

Care of respiration When the patient is turned he must be turned from one side to the other never on to his back, for fear that respiration may be interrupted. He should be given 200 000 units of penicillin daily in order to prevent pneumonia.

Care of bladder and bowels Acute retention of urine is unlikely and the patient is more likely to be incontinent. The bladder must, however, be watched and the patient catheterized if necessary If he is unconscious for a long time he may become constipated and require an enema.

Nutrition. If the patient is very deeply unconscious he may require an intravenous infusion, to provide fluid and glucose. Not more than 10–15 gm. of salt should be given per day As there are 5 gm. of salt in every bottle of normal saline the patient should not receive more than two to three bottles of normal saline daily, the rest of the fluid required being given as 6 per cent. glucose *in water* If too much salt is given it cannot be excreted by the kidneys and accumulates in the tissues. It attracts water to it and the patient may die because his lungs have become waterlogged.

Less severe cases can be made to swallow an oesophageal tube and can be fed through that, while patients who are only semi comatose, or who are recovering from deep unconsciousness, may be roused enough for them to swallow fluids given by mouth.

Prognosis

Unconsciousness may be prolonged for weeks or even months, but, so long as complications are avoided, full recovery should follow A few patients may suffer from persistent headaches and all may suffer loss of memory especially of the actual accident and perhaps of the events which took place a few hours or days before.

Very occasionally brain damage is followed by epilepsy, this may be controlled by medical means but in some cases it may be considered worth while to explore the area of brain damage and remove scar tissue.

CHAPTER 22

THE CHEEKS, MOUTH, NOSE, EAR AND THROAT

THE CHEEKS

Cancrum oris

THIS disease affects undernourished infants and young children. Infection occurs with organisms similar to those of tropical ulcers, and, as with a tropical ulcer, there is an early spread of infection into the surrounding tissue, with thrombosis of vessels and death or gangrene of the substance of the cheek.

Toxaemia is severe and, in undernourished young infants, it may cause death. If prompt treatment is not given the gangrenous tissue sloughs away leaving a large hole right through the cheek. This will heal with much scarring and deformity of the face and mouth.

In very early cases resolution may follow the giving of high doses of penicillin (say 50 000–100 000 units of soluble penicillin four hourly) and the disease may be arrested before it has spread through the cheek.

In late cases the infection should be controlled with penicillin and the defect in the cheek repaired by plastic surgery when the infection has completely subsided. It may be possible to close a small defect by using a flap of near by tissue, but severe cases will have to be treated by transferring skin from the chest or elsewhere. A pedicle-flap is used, one end of a strip of skin being fixed to the face while the other end is left attached to the chest. When the end which has been transferred to the face has developed a new blood supply, the pedicle can be divided.

SALIVARY GLANDS

There are three pairs of salivary glands; they are the parotids, the submandibular and the sublingual salivary glands.

The sublingual gland, lying under the tongue, rarely gives rise to any trouble, but *calculi* sometimes form in the duct of

the submandibular gland which passes close to the sublingual gland along the floor of the mouth, to open under the tongue. When the gland secretes saliva at the thought of food, or during meals the submandibular gland swells under the mandible because the saliva is unable to escape past the calculus

The duct lies close under the mucous membrane of the floor of the mouth, and the calculus can usually be felt there by an examining finger It can easily be removed by an incision into the duct under local analgesia.

Salivary calculi very occasionally form in the parotid gland or duct.

Infection. Infection of the glands is rare but an acute parotitis may occur in debilitated patients especially if the patient is febrile and dehydrated and the mouth has not been kept clean. If the infection does not respond to penicillin then incision will be required into the gland in order to release pus. This must be done very carefully so as to avoid injury to the facial nerve which passes through the gland on its way to supply the muscles of the face. The nerve leaves the skull below the ear and then, in the parotid gland, breaks up into branches which radiate towards the eye, the nose and the mouth.

An incision should be made over the site of greatest tenderness. The knife should divide the skin and the strong fascia over the gland, but it should not enter the gland itself for fear it should divide a branch of the nerve. A pair of artery forceps should be closed and forced in instead the blunt point will probably push the nerve branches out of the way and the hole can then be made bigger by opening and shutting the forceps a few times.

This blunt method of opening an abscess is very successful in many sites where there are important structures, such as the side of the neck or the palm of the hand. It is known as Hilton's method

Tumours

A not uncommon tumour is the mixed parotid tumour' or mixed salivary tumour It appears most frequently in the parotid gland but it is very occasionally found in other odd sites round the mouth such as in the palate.

The tumour is slow in growth and appears to be benign if examined pathologically If it is not completely removed how

ever, it is liable to recur and, when it does recur, it is apt to be more malignant.

The tumour has to be removed very carefully, so that damage to the facial nerve is avoided but every care must be taken to remove all of it, in order to prevent a recurrence.

If the tumour does recur a much wider excision will have to be made and it is unlikely that the facial nerve will then escape.

Damage to the facial nerve results in a weakness of the eyelid muscles and of the mouth. The mouth is pulled over to the opposite side of the face by the strength of the intact muscles on the other side.

THE MOUTH

Hare-lip and cleft palate

These are congenital abnormalities due to failure of parts of the embryonic face to join together before birth

The result is a split which may involve any part of a line which runs from the nostril along the floor of the nose to the back of the palate. The floor of the nasal cavity is, of course, the roof of the palate the nose and mouth cavities are no longer separated if the palate is split.

The deformity may occur on one or both sides. It may involve only the lip or only the palate, or it may involve both. When the front part of the palate is split, the separation passes forwards between the teeth so that the upper jaw is divided in two

Surgical repair is indicated for several reasons apart from the question of appearance. The lip should be repaired early for when the two parts are joined together its muscles will help to mould the rest of the face and prevent further deformity of bone. It is usual to carry out the repair when the infant is about two to three months old.

The palate must be repaired before the child begins to speak, otherwise it will have great difficulty in being able to talk clearly The repair should not be carried out until the child is about one and a half to two years old The operation is easier then. Besides, if it were done earlier, there would be increased danger that the upper jaw would be held tightly together and fail to grow so that the teeth would not meet well with those of the lower jaw when the mouth is shut. The earlier the operation is done,

sinuses if they are affected In mild cases the swelling of the mucous membrane may be made to shrink by giving the patient inhalations of compound tincture of benzoin or menthol or by prescribing nasal drops of ½ per cent. ephedrine in saline Oily solutions should not be used Once shrinkage of the mucous membrane has occurred the sinus will drain naturally

In some patients repeated infection results in a chronic inflammation of the mucous membrane of the sinuses. In these cases the sinuses may have to be drained by a surgical operation and if this is insufficient, the sinus may require to be opened so that the infected mucosa can be removed Mild recurrences sometimes recover with treatment by penicillin and local heat given by short wave diathermy

Congenital abnormalities

The only abnormality of surgical importance in the nose is a deviation or bending of the septum. If a patient has a deviated septum it may make it difficult for him to breathe through one nostril and infection will be more likely in the corresponding sinuses The septum may have to be straightened at the same time as the infected sinuses are treated. This is done by removing the cartilage and bone from inside the septum leaving only the soft-tissue walls. This operation is called a submucous resection of the nasal septum.

Epistaxis

Bleeding may follow an injury to the nose or it may be associated with a high blood pressure or other medical diseases such as polycythaemia. In most cases it has no obvious cause. The majority of cases respond to simple treatment by laying the patient down and keeping him quiet. More severe cases may be controlled by inserting into the front of the nose a small plug soaked in liquid paraffin and getting the patient to press on it from the outside. Adrenaline plugs should not be used as the vasoconstriction will be followed by vasodilatation and possibly fresh bleeding

Severe cases may require cauterization of the bleeding point at the front of the septum or tight packing of the nose with gauze soaked in liquid or soft paraffin Penicillin should be given to

prevent infection if a plug has to be left in for more than twenty-four hours.

Foreign bodies

Children frequently explore the orifices of the body and insert beads, buttons or seeds in them and then cannot get them out again. Seeds are particularly difficult to remove as they may swell with moisture. It is extremely difficult to grasp such an object with forceps and it may be pushed farther in by the effort. The best method of removal is to slide a small hook or bent piece or wire *past* the foreign body and hook it out. If no other instrument is available a large paper-clip may be bent to the right shape with forceps and then sterilized.

Removal is made easier if the mucous membrane is anaesthetized and the vascular congestion is reduced. The nasal cavity in front of the foreign body should be sprayed first with 5 per cent. cocaine hydrochloride (9 parts) and 1 1 000 adrenaline (1 part)

THE EAR

In all cases of earache it must be remembered that the pain may be coming from dental caries The teeth should be inspected if no obvious cause can be found in the ear

The external ear

The lobe of the ear is a soft structure, commonly used for adornment. Women with intact lobes may wish to have them pierced so that they can hang ear rings from them and men and women from those tribes which pierce and stretch the lobe in childhood may wish to have the edges of the hole excised, the surplus stretched skin removed, and the ear restored to its natural shape again.

Boils sometimes occur in the skin of the external ear, over the cartilage. The skin is tightly adherent to the cartilage and cannot stretch The result is that boils in this site are extremely painful.

The external auditory meatus

Boils may also occur in this site they cause very severe pain and, when they burst, they give rise to a discharge from the ear

In either stage they may be confused with acute inflammation of the middle ear, which is a much more serious condition. Inspection of the ear with an auroscope will show the presence of a boil close to the orifice, if this is the cause of the trouble, it will be found that the swollen, painful boil will prevent the insertion of the auroscope sufficiently far to be able to see the drumhead.

In the early stages a boil is treated by the application of local heat and by giving the patient analgesic drugs such as aspirin to reduce the pain. Once the boil has burst the pain will be very much relieved. The pus should be swabbed out of the ear by a small piece of cotton wool wrapped round a probe or a match stick, and the area should be painted with flavine in spirit to prevent the development of further boils.

Wax arises from the secretion of the glands within the external auditory meatus. It is normally small in amount and semi liquid, so that it flows to the outside of the ear and is removed by washing In some people the wax is of thicker consistency and accumulates within the ear against the drum.

Wax in the ear is the most common cause of deafness The plug of wax can be seen lying within the ear when the ear is inspected by an auroscope. If the wax is relatively soft it can be driven out by injecting sterile water or bicarbonate of soda through an ear syringe Sometimes the wax is too hard to be removed immediately in this way and will first have to be softened by dropping olive oil into the ear and leaving it there for one or two nights before syringing

Foreign bodies

See under THE NOSE, page 211

Otitis externa

Inflammation of the external auditory meatus may develop especially in hot, humid climates as a result of moisture and a lack of cleanliness The first symptom is itchiness in the ear as a result of which the patient scratches the ear and encourages infection to develop This is followed by an irritating watery discharge.

Treatment

The most important step in treatment is to dry the ear repeatedly with cotton wool on the end of a probe or matchstick. After

drying the ear a wick of ribbon gauze should be soaked in 8 per cent. aluminium acetate and left in the ear for 24 hours This usually results in a rapid cure, but in some cases the treatment may have to be repeated. Thereafter the patient must be careful to keep the ear clean and to avoid scratching it if it itches.

Otitis media

Inflammation of the middle ear occurs in a number of forms and may be seen for the first time at any one of its various stages Mild cases may recover with or without treatment, at any stage of the infection but severe ones may steadily progress and may develop serious complications or lead to death unless proper treatment is given promptly

Pathological stages and treatment

(1) *Acute catarrhal otitis media* The inflammation begins as a mild infection of the lining mucous membrane, the infection having travelled up the Eustachian tube from the throat. It may accompany a simple coryza or any of the upper respiratory infections. The patient complains of mild pain in the ear and on examination, the tympanic membrane, or ear-drum, may either appear normal or slightly reddened but normal in shape

The treatment is that of the original cause. The ear ache may be relieved by inserting into the ear drops of warm oil or of 5 per cent. carbolic acid in glycerine.

(2) *Acute suppurative otitis media.* An increase in the inflammation gives rise to the formation of pus within the cavity of the middle ear This may be small in amount and may be absorbed when the inflammation subsides but if pain in the ear increases, examination may show that the drum is reddened and possibly bulging outwards The temperature will be elevated to 101°–103

Prompt treatment is required at this stage to prevent further complications. The patient must be given large doses of penicillin, for example 200 000 units at once, followed by 100 000 units four hourly Drops of carbolic acid in glycerine, local heat and analgesics may also be given to relieve pain.

The drum must be examined repeatedly at intervals of not more than six hours If the drum is found to be bulging out-

wards at any time, it must be incised under a general anaesthetic (*myringotomy*) An *incision* is made with a special knife, called a myringotome, in the posterior part of the drum This clean cut will heal readily when infection has been overcome. If the incision is not made the drum may burst or the inflammation spread through the tympanic antrum of the mastoid air-cells

(3) *Perforation of the drum.* A drum that bursts itself usually perforates in the centre or in the upper part. The hole is made through tissue that has been damaged by the infection and it is often too large to heal over again. Secondary infection may enter by the external meatus and a chronic otitis media will develop The continuation of the infection may destroy the little bones in the ear which conduct sound and deafness results

If a patient is seen with acute otitis media when the drum has already burst, he must be given penicillin for the infection, and the ear must be very carefully cleansed of pus at frequent intervals A dressing should be put over the ear to prevent infection from entering from the outside but the ear must *not* be plugged with cotton wool, as this will dam the pus in and increase the danger of spread. If infection has been brought quickly under control there is a chance that the perforation will heal.

(4) *Acute mastoid infection.* Infection which spreads to the mastoid process causes pain and swelling in the bone behind the ear The skin over the mastoid is raised up by oedema and this pushes the ear forwards. One must be careful, however to distinguish mastoiditis from an inflammation of the lymph-gland behind the ear This may be acutely inflamed from a boil in the external meatus or from infection in the scalp and septic spots should always be looked for there in a doubtful case.

Early cases of acute mastoid infection may resolve after treatment with penicillin, but infection may be very severe or treatment may be given too late. In these cases pus may form in the bone. *A purulent mastoiditis is really a form of osteomyelitis* and behaves in the same manner The pus may remain within the bone or it may burst through to the surface and form an abscess there. A subperiosteal abscess is not dangerous and can easily be drained by an appropriate incision. The dangerous form of abscess is one which has formed on the inner surface of the bone *that is inside* the skull.

An abscess inside the skull will give rise to a local or general

meningitis, it may cause infection and thrombosis of one of the big venous sinuses leading to the internal jugular vein or it may penetrate through the meninges and cause a brain abscess

When these complications occur the patient is seriously ill with profound toxaemia and he may even be in coma.

The mastoid bone must be opened and drained in any case of acute mastoiditis which does not respond to penicillin treatment within twenty-four hours Operation becomes an urgent emergency if there are any signs of inflammation within the skull

Summary Acute otitis media must be treated energetically A bulging drum must be incised at once and a severely inflamed mastoid bone must be drained if serious complications are to be avoided. Fortunately owing to the use of penicillin, serious cases are not now often seen.

(5) *Chronic otitis media* A neglected case, with a perforated drum will develop chronic infection of the middle ear and this may be accompanied by chronic infection of the mastoid bone.

Mild cases may clear up with treatment, but they are always liable to relapse if the patient develops an upper respiratory infection or if secondary infection enters through the perforation.

The ear must be kept clean and dry and the patient must avoid getting water into the ear while either washing or sea-bathing

When infection flares up a fresh course of penicillin will be required sometimes one of the other antibiotics will be necessary if the organisms have become penicillin resistant. The ear is carefully cleaned by a woollen swab on a probe or match-stick until all pus has been removed, and then three drops of methylated spirit are inserted. Careful cleansing and treatment with spirit usually relieves the attack, but it is no use giving penicillin or inserting spirit drops unless the ear is properly cleansed first.

Persistent infection that does not respond to this treatment suggests that diseased bone or other tissue is present. An operation will then be required to remove all the diseased tissue.

THE THROAT

The pharynx

The pharynx is that part of the throat which lies behind the nose, the mouth and the larynx. It continues below as the oesophagus.

In the pharynx there are many scattered collections of lymphoid tissue whose chief function is to guard the body against inspired infection. Two large collections of this tissue are the *adenoids in the nasopharynx* and the tonsils on either side between the mouth and pharynx.

Acute tonsillitis The tonsils readily become inflamed when the body is exposed to droplet infection by streptococci and other organisms The tonsils become enlarged and inflamed, but this is their normal defensive action and should not cause serious worry The inflammation is a sign that the body s defences are at work. Pain may be relieved by aspirin gargles and the patient should be kept away from work for fear of spreading infection to others. This is particularly important if the person is a member of the hospital staff, as the infection may be spread to patients especially if they are surgical cases with open wounds.

If there is severe toxaemia the patient will have to be treated in bed, and he may require penicillin injections. The patient should not be admitted to a surgical ward.

Quinsy Occasionally a peritonsillar abscess forms. This is known as a quinsy It is shown by a red fluctuating swelling in the soft palate just above the tonsil If pus is present it should be released by an incision into the abscess through the soft palate. A short general anaesthetic will probably be required and the patient should be laid on his back on the operating table with his head hanging down over the end of the table or with the shoulders raised on a large sandbag so that the head hangs down. This will prevent pus from running down the throat towards the larynx and the lungs after incision of the abscess instead it will run up the palate towards the mouth where it can be swabbed away A sucker is a useful instrument, if it is available, for rapid removal of the pus.

Chronic tonsillitis Repeated infection of the tonsils gives rise to a chronic swelling of the glands. Infants and young children have little natural resistance to infection and they are constantly suffering from coryza and sore throats. As a result the tonsils are frequently found to be enlarged. This is not an indication for their removal they are enlarged because they are resisting infection Very frequently they will be found to return to a normal size after the age of three or four

The tonsils are sufficiently seriously infected for them to be removed if one or another of the following signs is present

(1) The tonsils are sufficiently big to obstruct eating or breathing

(2) The tonsils have remained persistently enlarged after the age of five and the patient is still having repeated attacks of sore throat.

(3) The lymphatic glands in the neck, opposite the tonsil, remain enlarged and tender between attacks.

The operation is known as a tonsillectomy

Adenoids Collections of lymphoid tissue lie on the back wall of the naso-pharynx, these also may become chronically inflamed and enlarged When enlarged they are called adenoids. They may block the mouth of the Eustachian tube and prevent air from getting into the middle ear This can cause partial deafness

They may also be sufficiently enlarged to cause obstruction to nasal breathing The child constantly breathes through its mouth, especially when it is asleep there is also an increased tendency to infection of the nasal sinuses and also of the respiratory system, with recurrent bronchitis, owing to mouth breathing

The shape of the face slowly alters owing to the lack of use of the nose and the constant downwards pull of the lower jaw on the soft tissues of the face. The appearance is so typical it has been called the adenoidal face' The nose is narrow with immobile nostrils and the face appears to be slightly hollowed on either side of the upper nose.

This is a definite indication for removal of the adenoids by a special instrument called an adenoid curette. If the case has been neglected for a long time, the child will have to be given exercises afterwards to teach him nose breathing

Retropharyngeal abscess An abscess sometimes forms behind the posterior wall of the pharynx, opposite the mouth and the base of the tongue. The abscess usually results from an acute throat infection, but it may be a cold tuberculous abscess which has tracked forwards from the cervical vertebrae.

As the swelling enlarges it slowly pushes forwards the posterior wall of the pharynx and gives rise to great difficulty in swallowing and possibly in breathing If breathing is seriously obstructed an urgent tracheotomy may be required.

A pyogenic abscess may be incised through the mouth by plunging a knife into the swelling Again the head should be

brought over the end of the table and allowed to hang down, so that the pus will flow up into the mouth and nose instead of down into the throat and lungs A sucker will be a great help in removing the pus.

When the abscess is known to be tuberculous it should not be opened *into the mouth, because of the risk of secondary* infection of the vertebrae. It should be opened by a surgeon by a dissection in the side of the neck behind the sternomastoid muscle.

Tumours A rare variety of tumour may arise in the lymphoid tissue of the pharynx. These tumours are usually highly malignant and often invade the glands of the neck before they cause any trouble in the throat. They are often sensitive to powerful X rays but if these are not available and the *disease is not too far* advanced, an attempt may be made to treat them by surgical excision.

The larynx

The larynx is a very small area between the pharynx and the trachea It contains the vocal cords, which are able to move inwards and outwards during speech.

The cords are occasionally attacked by tuberculosis or tumours These will give rise to an alteration in the voice. Tuberculosis will usually be secondary to open tuberculosis of the lungs and it will probably not heal until the lung infection is controlled. Tumours may be removed surgically or treated by radium in their early stages

The muscles of the larynx are very important, as it is their contraction which alters the distance between the cords and so alters the voice. The larynx may be totally closed by the muscles for example when the patient is straining hard with his abdomen and is holding his breath In this case he is able to relax the cords and breathe again when he wishes, but he may not be able to do this on one very important occasion this is when the larynx is in *spasm* due to the irritation of an anaesthetic. Ether is the safest anaesthetic for general use but it is very irritant and can easily cause spasm in the early stages of anaesthesia if it is given too quickly The spasm usually relaxes if the anaesthetic mask is removed and the patient is allowed to breathe pure air again but if it does not, then the anaesthetist may have to

pass a tube down from the mouth, and between the cords into the trachea. If an expert anaesthetist is not available, then an urgent tracheotomy may be required

Spasm of the larynx may also occur, even under intravenous anaesthesia with pentothal, it is rarely complete, but it may be prolonged, and pentothal should never be given unless oxygen and a mask are available, so that oxygen can be driven into the lungs past the almost closed cords.

Acute obstruction of the larynx Obstruction may be caused by diphtheria, which is uncommon in Africa, and it may also accompany a tracheobronchitis in young children. Oedema of the larynx may develop in the presence of infection in the pharynx and in the soft tissues of the neck (p 221) The oedema of the larynx may be sufficiently great to obstruct breathing and, again an urgent tracheotomy may be required.

Tracheotomy When breathing is obstructed by closure of the larynx or pharynx an artificial opening must be made below the obstruction in order to save the patient s life.

The operation may have to be done urgently with the patient already unconscious. In this case no anaesthetic is required, a knife is thrust through the skin deep down into the trachea, it is turned sideways and a pair of forceps passed into the trachea alongside. The knife is removed, the forceps opened and a tracheotomy tube pushed in. The tracheotomy tube is held in place by tapes which are tied round the patient s neck.

The tube has an inner tube which can be taken out every four hours and cleaned and the nursing staff must watch the patient carefully and see that the tube does not get blocked with mucus

If the patient is still conscious and the obstruction is not complete, the tracheotomy may be done as a careful operation with proper dissection, under a local anaesthetic. It is not wise to give this patient a general anaesthetic, as the irritation may complete the obstruction, so that an urgent, difficult operation will have to be done instead of a careful, deliberate one. It is very much better to do a tracheotomy when obstruction is threatened rather than wait until it is complete. If one waits, one may be too late.

Foreign bodies in the larynx These are described at the end of the next chapter together with foreign bodies in other parts of the air and food passages

CHAPTER 23

THE NECK

INJURIES

THE most frequent injury to the neck is a subluxation or a dislocation of the cervical vertebrae. These injuries have been described in a previous chapter (See Chapter 19.)

Cut throat

The commonest injury to the soft tissues is a cut throat, either as an attempted suicide or an attempted murder In an attempted murder usually only one deep cut is made, a patient who attempts suicide is frequently more timid to start with and makes a very superficial cut, but, being in a mentally abnormal condition and becoming more and more desperate, he or she will repeat the cuts deeper and deeper Thus several parallel cuts across the neck are very suggestive of attempted suicide.

The larynx and trachea are the most prominent structures in the neck, lying directly under the skin and subcutaneous tissues, and they are frequently divided on either side of them there lie large subcutaneous veins, including the external jugular and these may give rise to quite extensive haemorrhage if they are divided

The carotid arteries internal jugular veins and vagus nerves lie more deeply on either side and are surrounded by quite a strong sheath of connective tissue. A knife frequently pushes them backwards out of the way and opens the oesophagus before it opens the carotid sheath

If the cut has been made really deeply the carotid vessels will also be divided and the weapon may actually enter the vertebrae. Such a severe injury is usually fatal.

So long as the carotid sheaths are intact, the patient has a good chance of survival The division of the trachea has made an accidental tracheotomy opening and the patient is able to breathe through that If the oesophagus has also been opened then

saliva swallowed by the patient escapes through the wound, if the oesophagus is intact, then swallowing will naturally not be interfered with

Treatment

When the case has been brought to hospital soon after injury the usual routine treatment for wounds will be applied Haemorrhage must be controlled, if necessary by catching large bleeding vessels in artery forceps Shock must be treated and the patient then taken to the theatre for treatment of the wound

A tube can be passed into the trachea, after giving pentothal, in order to maintain the anaesthetic with gas (nitrous oxide) or ether or other anaesthetic. The tube can be passed from the mouth or nose if the trachea is undamaged, or it can be passed directly into the trachea through the wound.

The wound may then be excised and the oesophagus and trachea repaired The skin will only be stitched if it is safe to do so

The loose cellular tissue of the neck is easily infected, and infection will track, with gravity down into the chest. Penicillin will therefore be required for every case, and the dose will depend upon the degree of infection that is already present.

Some cases are brought to hospital many hours after injury when severe infection has already developed in the wound. These patients will require treatment for infection before any attempt is made at repair The patient can breathe through his tracheal wound, and he can be fed through an oesophageal tube passed into the stomach from the mouth and across the gap in the oesophagus.

Dressings will have to be carefully arranged in order not to obstruct the tracheotomy tube, and the patient must be encouraged to spit out his saliva, rather than swallow it.

LUDWIG S ANGINA

This is an infection of the soft tissues of the neck, which begins at the upper part of the throat. Swelling very rapidly becomes great, owing to the loose nature of the tissue.

Oedema causes a large swelling of the neck below the mandible, and it also causes a swelling of the floor of the mouth and tongue

so that the tongue is raised up towards the roof of the mouth and pushed forwards between the teeth.

The swelling of the tissues and of the tongue gives rise to difficulty in swallowing and breathing, and, if the condition progresses the vocal cords may also become oedematous and cause total obstruction to breathing

In early cases the patient may be cured by treatment with penicillin. Kaolin poultices are applied to the neck, and the patient is sat up with a back-rest, to reduce oedema and to make breathing easier

Threatened suffocation will require urgent operative attention. The swelling must be incised and opened up by Hilton's method, the forceps being passed through from under the mandible towards the floor of the mouth and opened up there. Instruments must be made ready to carry out an immediate tracheotomy as the patient may stop beathing while under the anaesthetic. General anaesthesia should be avoided as respiration may easily stop during induction.

LYMPHATIC GLANDS

The main group of cervical lymph-glands lies in a chain along the line of the carotid arteries Their chief drainage area is the throat, but they also receive lymphatics from the face and mouth. The 'tonsillar gland' lies at the upper end of the chain behind the angle of the mandible, opposite the tonsil

The glands may be swollen by acute or chronic infection, or by tumours Careful differential diagnosis must be made in every case, in order to reach the correct decision with regard to treatment. Diagnosis is usually easy, but, in some cases it may be so difficult that a final decision cannot be reached without first removing a gland for pathological examination. A biopsy of cervical lymphatic glands can be made under a local anaesthetic a fairly big incision is required, as the glands are always much deeper from the skin than one would imagine

Acute infection

The glands are only slightly enlarged, but they are acutely tender The history is short and the patient has either an acute tonsillitis or a skin infection in the drainage area.

The glands rarely suppurate, and the infection subsides when the primary source has been controlled Local heat may be applied with a kaolin poultice.

Persistent acute infection

In cases of chronic tonsillitis, the lymphatic glands, especially the tonsillar gland, are liable to remain enlarged and tender Once tonsils have been removed the glands will shrink and lose their tenderness, but following their repair by scar tissue they may remain permanently palpable as small hard nodules.

Chronic infection

Tuberculosis is the most common cause of chronic infection Infection most commonly enters from the throat in this case the upper glands will be affected first and the infection will spread down the chain The infection may arise in the lungs however, and spread up to the neck from the mediastinal glands The lower glands are then enlarged first.

Considerable enlargement of the glands usually occurs, and the thickening of the neck can easily be seen as soon as the patient is examined. On palpation the glands will usually be found to be matted together in a solid block, although they may still be separate in the early stages. Later still fluctuation may be present, and aspiration, through healthy skin, will produce tuberculous pus On laboratory examination this pus may show tubercle bacilli and if injected into a guinea pig it will almost certainly cause severe general infection. Guinea pig results are not available for about three months.

Tuberculous glands are most often seen in young people, and the most likely alternative diagnosis is Hodgkin's disease (see below) In adults there is often very little toxaemia, and they are able to continue at work while undergoing treatment.

Treatment is on general anti tuberculous lines, with rest, good food, fresh air and specific drugs. Abscesses should be aspirated once or twice a week, and half to one gram of streptomycin inserted. The whole gland mass may be excised if it does not shrink fully by the time the general toxaemia has been controlled.

Tumours

Tumours of the cervical lymphatic glands are either primary or secondary to a malignant tumour elsewhere.

Lymphadenoma or Hodgkin s disease This disease is a slowly progressive condition that eventually leads to death It does not behave like any other tumour as it has a habit of progressing suddenly, usually with a general febrile reaction, and then showing a quiet interval before relapsing again. The course of the illness may be acute, with death in six months or so or it may be chronic with death not occurring for two to three years.

Enlargement of the cervical glands is usually noticed first, but other glands in the body are also frequently enlarged, for example in the axilla, the groin, the mediastinum and the abdomen. In the later stages the spleen also is invariably enlarged.

There is no known cure for the disease but certain chemicals, such as nitrogen mustard, may be able to postpone death for some time.

The disease is distinguished from tuberculosis by the fact that the glands do not become matted together but remain separate. They are rather like rubber in consistency The attacks are intermittent and the disease is steadily progressive. If one is in doubt, a gland may be removed for pathological examination.

Secondary carcinoma Carcinoma will be most likely to appear in older patients usually in patients over the age of fifty The primary cancer may be an obvious ulcer of the lips or mouth or tongue, or it may be a hidden tumour in the pharynx.

The enlarged glands are not necessarily invaded by malignant cells A malignant ulcer may be infected and the glands may enlarge because of bacterial infection. In this case they will shrink and almost disappear when the malignant tumour has been removed or cured by radium. If there is any doubt, the glands should be removed also

There are a few glands that lie just above the clavicle. These are known as the supraclavicular glands. Secondary carcinoma may develop in them as a result of invasion from carcinoma of the breast or even of the stomach.

THE THYROID GLAND

Injuries and infection of the thyroid gland are rare. The gland may develop an adenocarcinoma, but this also is not common.

The most common diseases of the gland are enlargement due to endocrine disturbance

The thyroid gland produces a hormone known as thyroxine This hormone circulates in the blood and helps to keep an individual alert and lively The thyroid gland requires iodine in order to make thyroxine.

Under production of thyroxine makes a patient lethargic and dull This condition is known as myxoedema, it is treated medically by giving the patient extract of thyroid gland to take by mouth. Over production of thyroxine (hyperthyroidism) makes a person over anxious and excitable This condition is very rare indeed amongst Africans but it may become more frequent as they become more exposed to the stress and strain and the hurry and bustle of modern civilized' life.

Hyperthyroidism may be controlled by drugs, but if this is not successful a large part (seven-eighths) of the gland should be removed surgically

The most common abnormality found in the thyroid gland of Africans is a benign enlargement called a simple goitre. This frequently develops as a result of a shortage of iodine in the diet and it may also develop where there is an excess of fluorine, and possibly other chemicals, in the drinking water So it is more common amongst certain tribes than others depending on the iodine and fluorine content of the water-supply in their districts For example, the tribes round Meru and Kilimanjaro mountains frequently suffer from this condition. It is more common among women than among men.

In the majority of cases no ill effects result from a simple goitre, but it may press on the trachea and cause obstruction to breathing This is particularly liable to happen if the goitre grows down into the chest behind the sternum.

Part of the gland can be excised surgically either to relieve pressure or to improve appearance. As there are no signs of hyperthyroidism there is no need to prepare the patient by giving Lugol's iodine or other drugs which, in toxic cases reduce excitability

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

The air and food passages extend from the pharynx in the neck to the oesophagus trachea and bronchi in the chest, but it will

be simpler to consider the thoracic parts of the passages together with the parts in the neck.

Children may swallow beads, coins pins safety pins, hair grips and all sorts of other objects and these may become held up at any point in the passages Small swallowed objects will normally pass right through the intestine, but, if they are sucked down from the mouth by a sudden inspiration of breath, they may be drawn into the larynx, trachea or bronchi

The child will have a sudden fit of coughing and may even die from spasm of the larynx. Some objects will be coughed up if they have not gone too far down, and this may be helped by turning the child upside down and giving the chest a firm blow If the object is not coughed up it will have to be removed by a pair of forceps passed down a bronchoscope.

Vomit must be included amongst the highly dangerous foreign bodies that can be sucked into the air passages This rarely happens in a conscious patient but may occur in an unconscious patient, whether the patient is unconscious from illness or injury or whether the unconsciousness is due to the induction of an anaesthetic. All unconscious patients must be nursed on their sides in the wards or during first aid treatment, so that saliva and vomit can flow out of the mouth instead of down into the lungs Furthermore, a general anaesthetic should *never* be given to a patient who has had a meal within the last four hours.

Vomit or saliva may also be aspirated into the chest if the pharyngeal muscles are paralysed, for example when poliomyelitis affects the lower brain (bulbar poliomyelitis) These patients will require very specialized treatment to assist respiration and great care must be taken to see that they are unable to aspirate fluid into the lungs.

Fish bones are the most common objects to stick in the food passages of adults, although larger objects such as meat bones or false teeth may also be swallowed and become stuck.

Fish bones most frequently damage the walls of the pharynx. They may stick in the walls or simply scratch the surface and pass on. In the latter event when the patient tries to swallow he has a sharp pricking sensation from the scratch and he thinks the bone is still there.

If examination of the throat shows that there is no bone present, but only a scratch the patient should be given an explanation that the pain is simply due to the scratch and that

it will disappear in one or two days. He should then be given aspirin tablets to ease the pain.

The majority of fish bones or fish bone scratches can be seen in the pharynx with a laryngoscope and the bone can be removed by forceps if it is present.

Larger objects both in adults and children, are usually held up at the upper end of the oesophagus and an oesophagoscope or a long pharyngoscope will be required to remove them. If an oesophagoscope is not available it may be necessary to remove the object by open operation.

A fish bone, or other sharp object, may perforate the wall of the pharynx or oesophagus. When this occurs infection will develop in the surrounding loose cellular tissue and will spread rapidly This infection may cause respiratory obstruction from oedema of the larynx or it may spread down into the chest. If the wall of the pharynx or oesophagus has been damaged by the object, either during swallowing or during its removal, the patient must be given large doses of penicillin to protect him from infection.

PART FOUR

REGIONAL SURGERY—THORAX AND ABDOMEN

CHAPTER 24

THE BREAST

INFECTION

ACUTE pyogenic infection of the breast is known as acute mastitis. It most commonly occurs in women who are feeding their children. Infection does not usually pass up the milk ducts but enters the breast through a cut or scratch in the skin of the nipple and then passes into the breast along the lymphatics

The breast is divided into many segments by thin walls of fibrous tissue, and each segment contains a mass of fat and a portion of the mammary gland. While the breast is at rest, that is when it is not secreting milk, the gland mass takes up very little room and most of the shape of the breast is due to the presence of fat. The glandular part enlarges considerably when lactation begins.

When infection enters the breast it usually enters only one segment. The patient feels pain and heaviness in that part of the breast it is tender and the skin over it is reddened.

Because of the infection in the breast the child must not be allowed to suck from that breast, but the milk should be expressed several times a day and thrown away If this is not done then secretion will cease and the mother will be unable to feed the child from that breast when she has recovered.

Early cases may resolve without suppuration if they are treated with penicillin and local heat from a kaolin poultice.

If this treatment fails and a breast abscess forms incision will be required. A small stab wound and the insertion of a drain under local anaesthesia is not sufficient. By the time an abscess has formed and is ready for incision it will have probably burst

through the thin fibrous wall of the first segment into one of the other segments of the breast. These other segments will not drain through a small incision made into the main cavity

The patient should be given a general anaesthetic, and the operator should scrub up and put on a pair of sterile gloves. When the incision has been made a finger is pushed into the abscess and the full extent of the cavity is explored. The finger will be able to break down the fibrous walls even farther and turn the several cavities into one big cavity

The abscess may then be drained with a piece of corrugated rubber, making sure that the rubber does not block up the incision wound. Penicillin will be continued until the acute infection has been controlled, and the milk must be extracted until the infection is over The child may then be put back on the breast.

TUMOURS

Chronic mastitis

During every month of a young woman s life the breasts enlarge a little in preparation for the possibility that she may become pregnant. If pregnancy does not occur the woman menstruates and at the same time the breasts return to normal

This constant enlarging and shrinking may cause no trouble at all. On the other hand, in some patients, the constant alteration results in a permanent thickening of the small lobules of glandular tissue in the breast. This occurs more commonly in women who have had no children than in those who have.

When the breast is examined between the finger and thumb small hard nodules may be felt, but it is not possible to feel these if the whole breast is pressed against the chest by the flat of the examiner s hand

The condition is unimportant and gives rise to little trouble except perhaps some aching pain in the breast. This can often be relieved by supporting the breast with a brassière

The condition is known as chronic mastitis because it was formerly thought that it was due to chronic inflammation. It has only recently been realized that it is due to recurrent stimulation by hormones.

The important point to remember is that multiple, small hard nodules, which cannot be felt when the breast is pressed

against the chest with the flat of the hand, are of no serious significance.

Benign tumours and cysts

Sometimes some of the nodules of chronic mastitis may become enlarged and form a cyst in the breast. Occasionally also benign tumours may develop from glandular and fibrous tissue, forming a fibroadenoma. These conditions are uncommon but it is important to remember that the patient or her doctor may wrongly believe a lump to be one of these conditions when, in actual fact, the tumour is malignant. The resulting delay may have fatal results

Carcinoma of the breast is very much more common than any benign tumour, and a cure can only be expected if it is treated in its early stages It is wisest therefore to suspect that *any* lump in the breast that can be felt with the flat of the hand may be cancer, and refer the case to a surgeon at once.

Carcinoma

Cancer of the breast arises from the glandular tissue and is therefore an adenocarcinoma

It occurs in women, usually over the age of forty and starts as a small local tumour in one part of the breast. When the tumour is seen at this early stage removal of the whole breast and the neighbouring glands of the axilla will give a very high chance of a complete cure.

Unfortunately this early stage is rarely seen An uneducated woman, and even many educated women, do not realize the very great importance of early treatment, and they may not even know that a lump is present until it has advanced to a late stage. Every woman should be taught to feel each breast with the flat of her hand once a month and to report at once if she feels a lump there. When a doctor or medical assistant feels such a lump he should send the patient to a surgeon *immediately*

Further development of the malignant tumour results in local growth local invasion and lymphatic spread.

Local growth results in the tumour becoming larger while local invasion results in the tumour becoming fixed to the surrounding tissue this will cause contraction of the surrounding tissue due to invasion by tumour and scar tissue, so that the nipple

becomes drawn inwards and is often raised to a higher level than the nipple on the opposite side. Further local invasion may cause adhesion to the skin and this will later ulcerate as the tumour grows through the surface. Infection of the ulcerated tumour leads to a nasty fungating, smelly tumour which will not heal The tumour may also become adherent to the pectoral muscles underneath the breast.

Lymphatic spread most often occurs to the *lymphatic glands* in the axilla, but it may also occur to the supraclavicular glands at the root of the neck, or between the ribs into the thoracic cavity *Once the lymphatic glands have been affected* more general spread is fairly rapid and secondary tumours may occur in bones such as the humerus, spine or femur A pathological fracture may develop in the site of a secondary tumour in bone.

Once the lymphatic glands have been invaded the chance of curing the patient falls very considerably, and when distant metastases have occurred, there is no chance of cure at all.

Examination of the breast for possible cancer

(1) Feel the lump with the finger and thumb and then with the flat of the hand The second palpation is best done with the patient sitting on a chair and with the *examiner standing behind* her and passing his hand over her shoulder

(2) Inspect the breast for indrawing of the nipple and a difference in the level of the nipples

(3) Test the skin over the tumour for local invasion by feeling whether the skin appears to be attached to the lump, and see whether the breast can be moved freely over the pectoral muscle. This should be done *after the muscle has been made tight* by the patient pressing her hand against her hip

(4) Palpate the axilla for possible glandular enlargement. The patient raises her arm and the examiner puts his fingers into the axilla as far as possible with the fingers facing the chest wall. The patient s arm is then lowered in order to relax the tissue in the axilla so that the examining fingers can move freely over the chest wall

Treatment

Unless the condition *is obviously chronic mastitis* refer *ALL* lumps in the breast to a surgeon *at once* If he considers that a

malignant tumour is present and there is any chance of curing the patient, he will probably remove the whole breast, together with all the tissue in the axilla, in one block. Where deep X rays are available the breast only may be removed and the glands treated by X-rays

THE MALE BREAST

Disease is very rare in the male breast. Sometimes the breast develops like a female one and it may then be removed to relieve the embarrassment of the patient. This condition known as gynaecomastia, is more common amongst male Africans than amongst men of other races. It may be associated with a racial difference in the production of hormones but is more probably the result of liver damage in childhood due to protein malnutrition. African males have much less hair on their limbs than European or Asiatic races and do not have the same tendency to become bald on the head, and this may be associated with a high level of oestrogen in the blood. A healthy liver destroys any excess of oestrogen in the male.

Carcinoma can also occur in the male breast. When it does occur it will invade the surrounding tissue and the lymphatics very early in the disease owing to the small size of the breast, and so it very rapidly passes to an incurable state.

spiration Healing is rapid and is usually complete in three weeks.

Treatment Simple injuries should be treated by the injection of 5–10 c.c. of 2 per cent. procaine into the fracture site This relieves the pain and allows the patient to breathe without discomfort, but he may still feel some pain on coughing The injection may have to be repeated daily for two to three days but, after that, repetition is rarely required.

It is frequently taught that the chest should be strapped in order to prevent any movement. Strapping can only prevent all movement of one side of the chest if it covers that side of the chest from top to bottom and passes right across the mid-line to the other side of the chest, both in front and behind. This treatment is unnecessary and may even be harmful as it will prevent the expansion of one lung This lung may already be bruised and pneumonia may develop if it is kept still.

The injection of procaine is sufficient to prevent pain on respiration pain during coughing should be relieved by sedatives and a cough mixture, and the chest may be partially supported by a strip or two of adhesive strapping When the patient has had a sedative he should be encouraged to cough in order to bring up sputum rather than retain his secretions in the lung Infection of the lung must be treated with sulphonamide drugs or penicillin.

A haemothorax is treated by aspiration of the pleural cavity and the aspiration must be repeated as often as blood re-forms. If the blood is left in the pleural cavity it will clot and fibrose there, leading to a permanent restriction of lung expansion.

Very severe injuries will require special attention, but the same general principles are applied. The patient is given a back-rest in order to assist respiration, morphine is given for pain, and penicillin for prevention of lung infection If a haemothorax or a pneumothorax is present, the chest will be aspirated of blood or air but if there is severe internal haemorrhage or rapid recurrence of a tension pneumothorax, the chest may have to be opened and the injured lung dealt with by a surgeon.

It is most important during chest aspiration to avoid any infection of the pleural cavity A two-way stop-cock should be used on the end of the syringe, so that the aspirated fluid can be ejected from the syringe without removing the latter from the needle. This will also prevent from being sucked into the

chest along the needle while the patient breathes Aspiration of blood or fluid should be carried out below the eighth rib posteriorly

A tension pneumothorax is treated by passing a needle into the chest in the space between the second and third ribs in front and then connecting it to a piece of tubing which passes into a bottle of sterile antiseptic. When the patient breathes out, air will be blown down the tube and cannot be sucked back in again.

Stab wounds

Stab wounds of the chest may cause an injury to the superficial soft tissues only or they may pass between the ribs and enter the pleural cavity The knife may then damage the heart or lung or even, if the stab wound is low down, pass through the diaphragm and puncture the liver or spleen.

In some cases more often seen in bullet wounds than stab wounds, the hole in the chest is big enough for air to be sucked in and out with each breath. The lung on that side collapses and respiration is seriously embarrassed. These wounds are known as sucking wounds They must be carefully covered over during first aid treatment, and the skin must always be sutured over them when they reach hospital even if infection is present.

The external wound must be treated according to standard procedure, with excision and suture of the wound if it is seen early enough.

Simple haemothorax or pneumothorax will be treated by repeated aspiration, while severe bleeding or a severe pneumothorax may require operation to explore the chest cavity

Coughing or spitting of blood will be strongly suggestive of lung damage, and so will surgical emphysema but neither will necessarily be an indication for immediate operation. (Surgical emphysema is shown by crepitation of air under the skin if palpated.)

A diaphragmatic hernia may develop through a wound in the diaphragm which has not been diagnosed and repaired.

Bullet wounds are rarely met with in civilian practice. They will be treated on the same lines as serious stab wounds.

EMPYEMA

An empyema is a collection of pus in the pleural cavity It is rarely seen nowadays and this must be related to the effective treatment of pneumonia by sulphonamides and penicillin.

An empyema may arise as a secondary infection of a traumatic haemothorax, especially if proper care is not taken during aspiration of the chest. Alternatively it may follow infection of the lung

The lung infection may be pneumonic from the pneumococcus, broncho-pneumonic from secondary pyogenic infection (for example in influenza or following aspiration of foreign bodies or vomit) or amoebic from an amoebic liver abscess which has ruptured into the lung The last condition is the most uncommon of them all. It is accompanied by a high, irregular fever a swollen tender liver and, usually the expectoration of purple-red pus from the lung abscess.

If the temperature does not settle to normal soon after the treatment of a pneumonia or a haemothorax, an empyema should be suspected. Percussion of the chest will show complete dullness at the base, and auscultation will show absence of breath sounds. If the chest is aspirated, pus will be found.

The treatment is to aspirate the chest until all pus has been evacuated, and to repeat the aspiration until either the patient has been cured or the pus becomes too thick to flow out of the needle. Precautions must be taken, by using a two-way stop cock, to prevent secondary infection from entering and the patient will of course, be treated with appropriate doses of penicillin until the infection has been overcome. Repeated X-ray examinations if X rays are available, will assist in the diagnosis and the judgement of progress

When the pus becomes too thick to aspirate, the chest must be drained surgically This may be done by inserting a drain between two ribs in a child, but in an adult a portion of a rib will have to be removed. This operation is known as a rib-resection and drainage. The drain should be put in at the lowest part of the pleural cavity in the region of the eighth rib postero-

laterally Drainage must be continued until the abscess cavity has disappeared.

THE LUNGS

Lung abscess

An abscess of the lung may follow the aspiration of a foreign body, or it may result from an unresolved pneumonia. The abscess will be suspected if the temperature persists and there is an area of dullness in one lung X-rays and aspiration show that the abscess is in the lung and not in the pleural cavity A lung abscess will have to be drained surgically

Hydatid cyst

A hydatid cyst of the lung is difficult to diagnose An abscess will probably be suspected and then when the lung is explored, the cyst will be found to be present.

Tuberculosis

The signs, symptoms and treatment of tuberculosis of the lung will be found in medical text books

Surgical help in treatment, however has become increasingly common recently

During the stage of active disease the surgeon may be asked to assist in putting the affected lung at rest. This is commonly done by the physician by inducing an artificial pneumothorax or pneumoperitoneum, but there are other methods, such as division or crushing of the phrenic nerve to paralyse the diaphragm on the affected side, or massive rib resections in order to collapse the chest wall, which will require a surgical approach. The latter operation is called a *thoracoplasty* and it will not be done until the patient's general condition has improved sufficiently for the risk to be justified

In certain circumstances a surgeon may be asked to remove a whole lung (pneumonectomy) or a lobe of a lung (lobectomy) The decision to do this will be made in co-operation between the physician and the surgeon and it will not be done while the patient is suffering from tuberculous toxaemia.

Tumours

Carcinoma of the lung appears to be becoming more common in Europe and America. Its incidence in Africa is unknown. Early cases can be treated by removal of the affected part of the lung but the results of operation are poor

Secondary tumours appear in the lungs in many malignant diseases They appear on X ray as round balls in the lung and the lung should be X rayed in order to exclude them if a malignant tumour, for example of the breast or of bone, appears to be very advanced.

THE OESOPHAGUS

Foreign bodies, arrested in the oesophagus, are mentioned at the end of Chapter 23

Carcinoma of the oesophagus is not uncommon The first symptom is usually some difficulty in swallowing total obstruction occurs in the late stages.

Patients are rarely seen in the early stages when a major operation might be able to cure them. If obstruction has advanced to the stage when even fluids cannot pass, the patient's condition may be partly but temporarily relieved by making an opening into the stomach (gastrostomy) for feeding purposes. Fluids may then be introduced by a tube passed through the hole in the abdominal wall.

is crushed against the lumbar vertebrae. In this case perforation may occur several days after the accident.

Effects

Pain is again the most marked symptom. This time it is not colicky but it is intense and continuous The pain is due to severe irritation of the peritoneum by the contents of the bowel The same irritation will give rise to *board like rigidity* of the abdomen. Treatment within six hours of perforation may well be life saving After that the leakage of bowel contents has given rise to bacterial inflammation, that is peritonitis, and the out look becomes progressively more grave. As the peritonitis develops the rigidity slowly relaxes and the bowel becomes paralysed The effects of bowel paralysis are *distension without colic*, and the stethoscope will reveal a *silent abdomen*

INFLAMMATION

Acute peritonitis may result from blood borne infection per foration of the bowel or rupture of an infected appendix or Fallopian tube. With modern sulphonamide and penicillin treatment it is not always necessary to operate at once on a case of peritonitis *unless* a ruptured appendix or a perforated bowel is suspected. These will be suggested by the area of greatest pain.

Effects

These are the same as have already been described under perforation and there will also be fever from toxaemia. A history of really severe pain beginning in the upper abdomen the lower abdomen or the right iliac fossa, will suggest the possible origin of the inflammation

HAEMORRHAGE

Haemorrhage into the peritoneal cavity may come from rupture of the spleen or liver following injury or from the rupture of an ectopic gestation A gestation is a pregnancy and ectopic means that it is in the wrong place—that is that it has occurred in a

Fallopian tube. The tube stretches as the pregnancy enlarges it then bursts, often with a serious intraperitoneal haemorrhage.

Effects

Haemorrhage into the peritoneum will give rise to *pain* and *rigidity* followed by paralysis of the bowel with *distension*, as in perforation or inflammation. There will not, however, be the general signs of inflammation and the *paleness* of the patient, *rapid pulse* and *shock* will suggest haemorrhage.

A haemorrhage just outside or behind, the peritoneum may give rise to similar symptoms as a result of irritation of the peritoneum by the blood that lies against it. These cases are only found in serious injuries such as fracture of the pelvis or rupture of the kidney

SUMMARY

Always suspect an acute abdomen if a patient has a *short history* of one or more of the following

Severe colicky pain
Severe constant pain
Sudden abdominal distension
Repeated vomiting
Complete constipation.

The only medical conditions that are likely to cause confusion are acute gastro-enteritis (usually accompanied by diarrhoea) and very severe ascites. The author has seen two of the latter cases both due to cirrhosis of the liver, in which the ascites was so great that pressure in the abdomen had risen until it obstructed the mesenteric veins In these cases the distension was only partly of gas most of it was due to free fluid, and the patients were completely relieved by tapping the abdomen. Both were suspected to be acute abdomens when first seen.

Finally, if you suspect an acute abdomen, refer the case to a surgeon as *urgently* as you can.

CHAPTER 27

ABDOMINAL INJURIES

CLOSED INJURIES

THE abdomen and its contents may be injured by a severe blow with a blunt object such as the end of a pole; or the corner or edge of a large stone following a fall, or by a crushing injury for example through being run over by a motor-car The blow may also come from someone s fist or foot or possibly the kick of an animal.

In injuries that arise from a fall or from a traffic accident there may also be injuries to other parts of the body

Severe injuries to the lower abdomen may cause a fracture of the pelvis and internal injury can be secondary to the pelvic fracture.

Injury outside the peritoneal cavity

Following any of these injuries the skin and abdominal muscles are bruised and quite a large haematoma may form within the muscles. This bruising will give rise to tenderness and some rigidity of muscle and so allowance must be made for this while examining the patient for internal damage.

A fracture of the pelvis may result in a large haemorrhage taking place outside the peritoneum, and this may also follow a rupture of the kidney The kidney lies within the muscular cavity of the abdomen but it lies behind the peritoneum and does not project into it like the liver, spleen and bowel. Haemorrhage behind the peritoneum is known as retroperitoneal haemorrhage

Haemorrhage lying against the peritoneum will irritate the peritoneum and give rise to local pain and muscle rigidity Again confusion may be caused so that one is uncertain whether there is an injury within the peritoneal cavity or not. In any case of doubt it is better to open the abdomen as soon as the patient is fit for operation, rather than miss a serious lesion If no internal lesion is found, then no harm will have been done by the operation.

Internal injuries

Any of the internal organs may be injured by a blow from a blunt weapon. The solid ones may rupture and cause an internal haemorrhage, while the hollow ones may perforate. The bowel may be severely bruised without perforation, but perforation may follow some days later when the necrosed area has sloughed away

Liver and spleen

These organs are the most likely to give rise to internal haemorrhage. The blow has been directed against the upper abdomen, and local pain and tenderness will be found there. The spleen may be ruptured by a very mild blow if it has been enlarged by disease.

The haemorrhage may be sudden and severe, or it may be more gradual and the severity of the symptoms will depend upon the degree of haemorrhage.

As the haemorrhage increases, all the signs of shock develop The patient is alert and anxious and the pulse will steadily rise. This will be followed by a fall in the blood pressure and, if the oligaemic shock persists untreated, a state of irreversible shock will develop

The major local sign of internal haemorrhage is abdominal pain which becomes generalized as the peritoneum becomes irritated. A large local collection of blood will clot and give rise to a local area of dullness in the abdomen. The fluid part of the blood can, however be made to flow to the lowest part of the abdomen, as the patient is turned over, and the dullness will shift with the fluid. This sign of shifting dullness is characteristic of free fluid in the abdomen and the presence of both local and shifting dullness is very characteristic of internal haemorrhage.

If the haemorrhage is not severe enough to cause death and the blood is left in the abdomen, the peritoneal irritation may give rise to paralysis of the bowel and distension. The abdomen will then be silent on auscultation. This condition of paralysis of the bowel is known as *paralytic ileus*

Treatment Internal haemorrhage necessitates a laparotomy or exploratory incision of the abdomen. This operation is an urgent emergency but it must not be carried out until shock has

been treated by the administration of blood or a plasma substitute raising the blood-pressure to over 100 systolic.

If paralytic ileus has already developed, a gastric tube must also be passed and kept in the stomach so that the intestinal contents can be aspirated (see Chapter 28)

When the abdomen has been opened, the liver and spleen will be inspected. Ruptures of the liver may be sutured but it is best to treat a ruptured spleen by splenectomy, removing the whole organ. The liquid blood may be collected in a jug containing sodium citrate filtered through gauze and returned to the patient as a transfusion

Kidneys

Injuries to the kidneys, if the haemorrhage is severe, give rise to a swelling and dullness in the flank. The haemorrhage behind the peritoneum may also give rise to peritoneal irritation as we have already mentioned.

The internal bleeding in the kidney will appear in the urine as a haematuria, and this may be present when there are no signs of bleeding outside the kidney

In mild or moderate injuries, the bleeding will cease with conservative treatment. The patient is given morphine and rested in bed and his general condition is watched, with particular attention being paid to the pulse and blood pressure. Every specimen of urine is collected in a glass and stood on a locker or table. The specimens are labelled with the date and time that the urine was passed and they are put in a row Each new specimen can then be compared with the previous one, in order to see whether bleeding is increasing or decreasing If the haemorrhage steadily decreases, no further treatment will be required, but if the haemorrhage continues the kidney will have to be removed

Stomach and intestines

Perforation of the bowel is unusual in closed injuries of the abdomen but it may occur and must be watched for

The perforation will give rise to peritonitis with increasing pain and rigidity of the abdomen, followed later by distension paralytic ileus and a decrease in the pain

If a perforation is suspected, the abdomen must be opened and the perforation closed.

Bladder

The bladder, if it is already grossly distended, may be ruptured by even a slight blow This is most likely to happen amongst drunken people. The patient may complain of very little pain, but he is unable to pass urine, and free fluid will be found in the abdominal cavity

The bladder is more commonly ruptured by a sharp piece of pubic bone in a fracture of the pelvis The patient gives a history of a severe injury and there is pain and tenderness in the region of the symphysis pubis and pubic rami. The bladder should be examined by percussion, and, if it is empty, free fluid should then be sought in the abdomen. The patient must *not* be asked to pass urine, in case there is also a rupture of the urethra but if he has already done so and there has been no blood in the urine, one may cease to worry, as it is obvious that no serious damage has been done to the urinary system. If the bladder is distended, it will again be obvious that the bladder has not been ruptured, but this will not exclude a urethral injury

In any case of doubt the patient should be catheterized. If the catheter enters the bladder and only withdraws a few drops of blood-stained urine or of pure blood the bladder should be explored.

If the bladder was very full at the time that it burst, the rupture may be into the peritoneal cavity but if the bladder has been punctured by a spike of bone it is more likely that the rupture will be in the lower part of the bladder, below the peritoneum. There will then be an *extravasation* of urine and blood into the loose extraperitoneal tissues.

The hole in the bladder must be repaired, and the bladder drained by either a suprapubic or a urethral catheter for a few days. If there has been extravasation of urine the extraperitoneal tissue will also have to be opened up and drained with rubber drainage material.

The bruised and stretched extraperitoneal tissue is likely to become infected and so it will be as well to prescribe a course of sulphonamide or penicillin treatment.

The urethra

The urethra is not strictly an abdominal organ, but it is convenient at this stage to consider injuries to it.

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The bruised and stretched extraperitoneal tissue is likely to become infected, and so it will be as well to prescribe a course of sulphonamide or penicillin treatment.

The urethra

The urethra is not strictly an abdominal organ but it is convenient at this stage to consider injuries to it.

The urethra may be damaged by a fall in which the patient lands astride a bar or pole. The urethra is then crushed between the object and the pubic rami in the perineum. The organ may only be bruised or it may be actually ruptured. Profuse bleeding may occur but this will cease if the patient is put to bed and given morphine and the urethra is then splinted by passing a catheter through it and tying the catheter in.

Rupture of the urethra by a fracture of the pelvis is a more serious condition. In this case the urethra is often torn across close to its exit from the bladder and the two ends are usually separated

The bladder is usually distended, but, if the patient passes urine, the urine escapes into the tissues of the perineum and extravasates into the scrotum and up over the abdomen under the skin. If there is any possibility of a fracture of the pelvis being present a patient must *never* be asked to pass urine. A catheter must be passed instead

If the catheter enters the bladder without difficulty and obtains clear urine, it may be withdrawn and the patient treated for an uncomplicated fracture of the pelvis

If pure blood is obtained, it is probable that the catheter has failed to reach the bladder and that the tip of the catheter is lying in the haematoma outside the urethra, having passed through the rupture

The patient must be referred to a surgeon at once. If no *surgeon is available a suprapubic cystotomy* should be done under a local anaesthetic, and the bladder drained by a de Pezzar or other self retaining catheter If there are no facilities even for this procedure the bladder should be drained by inserting a lumbar puncture needle into the bladder through the lowest part of the abdominal wall The needle can be left in the bladder to drain while the patient is transferred to surgical care.

Surgical attention is essential because the displacement of the urethra will have to be corrected and then it will have to be held in place with a catheter If this is not done the patient will never be able to pass urine normally again, but will have to have a permanent suprapubic cystostomy

When extravasation has already occurred before the surgeon sees the case, he will make multiple incisions in the perineum, scrotum and lower abdomen to relieve the tension and may later on have to remove sloughs of subcutaneous tissue.

STAB AND BULLET WOUNDS OF THE ABDOMEN

Open wounds may only enter the skin and soft tissues of the abdominal wall, or they may puncture the peritoneum. All such wounds should be carefully excised so that any puncture of the peritoneum will then be noticed.

Perforation of the bowel or injury to the liver or spleen should always be suspected if the peritoneum has been penetrated and a laparotomy incision should be made in order to explore the peritoneal cavity unless there is neither distension nor rigidity and the bowel sounds are normal several hours after the injury

Perforations must be repaired and injuries to the liver and spleen dealt with as in the treatment following closed injuries

Patients may be brought to hospital with complete prolapse of one or more loops of bowel through the wound. These patients must first be treated for shock meanwhile the prolapsed intestine is covered by a dry sterile towel. Gastric suction is also required in order to prevent, or treat, paralytic ileus.

Penicillin is given in large doses and, when the patient is fit for operation the intestines will be returned to the abdomen and the wound closed.

CHAPTER 28

GENERAL CONDITIONS OF THE ABDOMEN

DEEP INGUINAL ADENITIS

THE deep inguinal glands lie inside the abdomen deep to the inguinal ligament, between the peritoneum and the muscles lining the pelvis.

They may be enlarged by acute or subacute pyogenic infection and then form a large tender mass in the left or right iliac fossa. It is often impossible to find the original source of infection, but it may have been a small cut or an infected chigoe ulcer on the foot.

If the mass is on the right side, it may be confused with an appendix abscess but the latter usually rises higher up in the abdomen.

The patient may walk into the out patient department, and it will be seen that he walks with a limp and that the hip is held flexed and adducted This will suggest acute or tuberculous arthritis of the hip but it is really due to irritation and spasm of the psoas muscle. If the hip is flexed further by the examiner the psoas will be relaxed and it will then be found possible to rotate the hip quite freely

The adenitis may resolve with the application of kaolin poultices together with either sulphonamides or penicillin. Other cases go on to suppuration and a deep incision will have to be made above the inguinal ligament in order to release the pus

ABDOMINAL LYMPH-GLANDS

The mesenteric lymph glands lie in the mesentery of the small intestine and other glands lie along the sides of the large intestine and drain into the glands along the aorta.

The glands will be enlarged in appendicitis or typhoid fever but the enlargement is not usually [illegible] to make them palpable.

Tuberculosis may occur in the me[illegible]ls and give rise

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

In adhesions and strictures the intestine [illegible] will become more acute if the organ ruptures. In perforations the peritoneum is at once invaded [illegible] intestinal contents, while in a neglected intestinal obstruction the stretched and dilated bowel wall will allow organisms to pass through.

The peritoneum has very great powers of resisting bacterial infection. It responds in the same way as any other tissue by capillary dilatation and the exudation of fluid and leucocytes.

If it is at all possible the peritoneum will try to localize the infection in the area of primary infection. Bowel movements cease, and this will have some effect in preventing spread. The exudate then clots and will bind together loops of bowel and the omentum round the affected area until a definite abscess wall is formed round the spot.

Localized peritonitis

Localized peritonitis most commonly follows appendicitis or salpingitis. Pain, tenderness and rigidity are confined to the area of the infection, and a large mass will be felt there. The mass is composed of adherent omentum and coils of intestine.

The case is treated by local applications of heat in the form of a kaolin poultice. The patient is put on a fluid diet and given large doses of penicillin.

In favourable cases, the infection will be overcome and the bowel adhesions will loosen and the normal activity of the bowel will be restored an operation may then be performed months later in order to remove the damaged appendix or tube. In other cases an abscess will form and will require to be drained. The incision must be made well to the side of the peritoneal cavity and an endeavour must be made not to open the peritoneal cavity through the abscess wall for fear of setting up a general peritonitis

Tuberculous peritonitis

Tuberculosis of the peritoneal cavity takes two forms In the first there is a great collection of fluid forming an ascites The fluid may be tapped in the medical wards, but sometimes a laparotomy is performed in order to confirm the diagnosis. The surfaces of the peritoneum are then found to be studded with small tubercles. In many cases the patient makes a very rapid recovery after a simple laparotomy but the reason for this recovery is not known.

In the second variety there is very little formation of fluid instead there is a large production of fibrin and the bowels become densely adherent together This variety usually resolves with modern anti tuberculous treatment, but some strong adhesions may be left, and these may give rise later to intestinal obstruction.

A tuberculous abscess may form and may burst both into the bowel and on to the surface of the abdomen This will form a faecal fistula which is very difficult to treat.

PARALYTIC ILEUS

This is the name given to a paralytic distension of the stomach and small intestine, usually caused by irritation of the peri

toneum It may also develop owing to nerve injury in fractures of the spine, or may even follow the application of a plaster jacket. The last type of case is usually mild and subsides rapidly, especially if the patient is able to get up and walk about. If recovery is not rapid the plaster should be removed.

Peritoneal irritation may result from any of the four causes of an acute abdomen—perforation, obstruction, inflammation or haemorrhage. Ileus in these cases never develops immediately, but follows as a complication It can very often be avoided if prompt treatment has been given for the initial disease.

Signs and symptoms

The signs and symptoms will usually be additional to those of the original cause, but this will not always be so for example, the violent colicky pain of obstruction will gradually be replaced by absence of all peristalsis.

This absence of all peristalsis is the principal pathological sign in ileus. The abdomen is silent on auscultation, and the bowel *gradually distends with gas and with the fluid that has been* secreted into it. In a short time the distension may become severe.

The fluid which has been secreted is lost to the body and it cannot be reabsorbed and utilized until the paralysis has been overcome.

Owing to the lack of peristalsis, constipation develops and the constipation is absolute—that is to say there is not even any flatus passed. The fluid gradually rises up in the intestines fills the stomach, flows up through the oesophagus and is vomited. This vomit is often completely effortless the fluid being poured out, possibly by the pint, and usually without any nausea. The loss of fluid leads to dehydration and to loss of salt from the body The distension of the bowel leads to some bleeding from the mucosa, and this blood becomes altered and infected and may develop a faecal smell. The vomit is not true faecal vomiting as the fluid comes from the small intestine and not the large.

The main signs, then are abdominal distension, a silent abdomen, absolute constipation, and effortless vomiting, followed by dehydration.

Treatment

Both the cause of the ileus and the ileus itself must be treated. If the former requires an operation, however, the operation may have to be postponed until the treatment of the ileus has been started.

The treatment of ileus consists of three things gastric aspiration replacement of fluid, and rest to the bowel.

The paralysis of the bowel has led to distension, and distension leads to further paralysis A muscle cannot contract when it is already stretched to its fullest length. If peritonitis or haemorrhage or whatever was the original cause of the ileus has first been treated, the ileus may still persist until the bowel has been emptied. This cannot be done by the injection of prostigmine or other drugs nor by the passage of flatus tubes or the giving of enemas from below It can only be successfully done by aspirating out the fluid from above.

To do this a tube is passed into the stomach. A Ryle's tube may be used if that is all that is available, but a Jacque's or a Levine's oesophageal tube is better as the tube is wider and the holes are bigger Size 10 is the best.

The tube is passed through either the nose or the mouth, the latter route will be found to be more comfortable for the patient if a large tube is used for a long time. The tube is strapped to the patient's face so that he will not swallow it, and it is left in position until he has recovered This may be within twenty four hours, but it may not occur for five or more days

A chart is prepared marking every hour of the day the tube is aspirated hourly and the quantity of fluid measured and recorded. If no fluid is obtained at all one must suspect that the tube is blocked some water may be injected down it and aspiration again tried. If aspiration again fails the tube should be removed cleaned and reinserted.

In some hospitals the tube is connected to a special apparatus so that there will be continuous suction but there is a big danger, with this method that blockage of the tube may not be noticed, and hourly suction with a syringe is preferable.

The patient will probably complain that he has severe thirst. This is due to dryness of the mouth and throat, and it may be relieved by giving him small sips of water to wash out his mouth or to swallow He should be given a feeding-cup containing five ounces of water and allowed to drink all of that in sips during

six hours In this way one pint will be taken altogether in twenty four hours, and all of it will be aspirated out again This sum can be subtracted from the total of fluid aspirated in the same period, when one calculates the daily amount of fluid loss

The aspiration is continued until either only a few c.c. are being aspirated each hour or the patient has passed flatus indicating that the bowels are functioning again. The gastric tube may then be removed but must be replaced at once if the abdomen becomes distended or the patient vomits At this stage a flatus enema of turpentine may be given.

Fluid replacement

The patient must receive all the fluid he requires by means of an intravenous infusion for possibly several days It is unwise to set up the drip with a needle in the vein as it may constantly give trouble. It is wiser to cut down on a vein in the leg above the medial malleolus, and insert a cannula straight away If a cannula is well tied in, it will not be necessary to apply a splint; and the patient can then be turned over in bed every four hours in order to avoid pressure sores.

If the arm is used remember that a right handed patient will be more comfortable if that arm is left free. The pyjama sleeve may cause a constriction of the arm, and the jacket is also likely to be soiled by the gastric aspiration and may require to be changed. This cannot be done when the arm is connected to a drip-stand by tubing The same applies to pyjama trousers if a leg vein is used The jacket or trousers should, therefore, be removed before the drip is set up

When a splint is used for steadying an arm, a piece of Cramer wire should be used and bent comfortably at the elbow and the wrist, so that the patient can hold his elbow slightly flexed with the forearm pronated, the wrist slightly extended, and the fingers flexed in a position of comfort.

Type of fluid One litre (1 000 c.c.) of normal saline will be required daily to replace normal loss of fluid and salt in the urine and through the skin, etc. To this must be added one litre of saline for every litre of fluid obtained by gastric aspiration. Each litre of normal saline contains about ten grams of salt, and it is dangerous to give more saline than is strictly required for replacement, as the patient may receive too much salt and develop oedema of the lungs.

Any other fluid that is given during the day should be given as 5 or 6 per cent. glucose in *water*

The standard infusion bottle contains 540 c.c.—that is half a litre, plus 40 c.c. to provide for wastage in setting up the infusion and to allow some fluid to remain in the bottle when changing to a new one.

Thus a patient who is receiving all his fluids by drip *must* have two bottles of saline every twenty four hours, plus one bottle of saline for every 500 c.c. aspirated from the stomach. He may also require three or four bottles of 6 per cent. glucose for the treatment or prevention of dehydration.

Rest to the bowel. Apart from gastric suction and fluid replacement, the patient should be kept absolutely at rest, with frequently repeated doses of morphine. An adult should be given one-quarter grain every four to six hours, depending on his condition.

By careful nursing and close attention to these principles of treatment, recovery can be expected in most cases.

CHAPTER 29

HERNIA

An internal hernia is caused by the passage of a loop of intestine into a hidden pocket inside the peritoneal cavity It is very uncommon and is not likely to be discovered unless an operation is done for intestinal obstruction of unknown origin The condition will not be discussed further

An external hernia is the common variety of hernia. It consists of a protrusion of a sac of peritoneum through the muscle wall of the abdomen. The sac may contain a loop of intestine, a portion of the omentum or simply some serous fluid.

ANATOMY

In order to understand the formation of a hernia one must remember the general anatomy of the abdomen. The abdomen is a hollow cavity whose walls are composed of muscles which are attached to the spine, ribs and pelvis Not only the sides of the abdomen but the upper and lower ends are closed by muscle— the diaphragm above and the pelvic diaphragm of muscles below The muscles are all covered by sheaths of connective tissue or fascia, and this connective tissue is joined together to form a continuous lining which is only broken where abdominal contents pass into or out of the abdomen. These weak points are the sites of hernia formation.

Within the lining of the abdominal walls there lies the peritoneum, which forms a completely enclosed sac.

All the important structures of the abdomen including the intestines lie between the peritoneal sac and the connective tissue lining of the inner wall of the abdomen. The intestinal canal enters through a gap in the diaphragm and leaves through a gap in the pelvic muscles During its course the intestinal canal forms many loops which push forwards, carrying a fold of the peritoneum with them it does not actually pass through the peritoneal cavity, and all the blood vessels and nerves enter

the bowel from behind *between* the layers of the peritoneal fold. The fold is called the mesentery

The aorta enters and the inferior vena cava leaves the abdomen through separate holes in the diaphragm, and the blood vessels to the abdominal wall and the lower limbs must also pass out between other gaps in the muscles The same applies to the major nerves, they come from the spinal cord, enter the abdomen deep to the muscles and then find their way out again through small muscle gaps.

The kidneys lie behind the peritoneum, in front of the posterior muscles and the ureters pass down behind the peritoneum, to the bladder The urethra leaves the abdominal cavity by passing through the muscles of the pelvis—and so does the female genital canal, the vagina.

In the foetus the umbilical vessels also perforate the muscle layer at the umbilicus

Finally and most important in connexion with the develop ment of an inguinal hernia, there is the behaviour of the foetal testicle. This organ is originally formed close to the kidney It has attached to it a small band of fibrous tissue which passes through a gap in the muscle wall to be attached to the skin of the scrotum. As the foetus grows, this fibrous band fails to stretch and the testicle is held down to the scrotal skin while the rest of the body grows away This is called the descent of the testicle.

As the testicle passes down it eventually passes through the abdominal muscle wall *above* the inguinal ligament and, on its front surface, it drags with it a small sac of peritoneum. This sac will form the tunica vaginalis of the testicle, and its con nexion with the abdomen should normally be absorbed before the child is born

You will notice that every structure that has been mentioned has passed through a gap in the muscle wall and the under lying fascia, either to enter or to leave the abdomen other gaps may also be formed by operation incisions, if the muscle wall has been divided and has failed to heal.

A hernia is a protrusion of a sac of peritoneum through one of these gaps. It can be an inguinal hernia alongside the vas deferens and the blood vessels and nerves of the testicle or a femoral hernia alongside the femoral vessels or an umbilical hernia through the umbilicus or a diaphragmatic hernia beside

the aorta or oesophagus, or an epigastric hernia where small vessels come through in the middle line above the umbilicus or an incisional hernia through a poorly healed wound Rare hernias may also occur alongside various other nerves and vessels, for example through the obturator foramen. Lastly, a 'hernia may form through the pelvic diaphragm in women, permitting a prolapse' of the uterus Although similar in nature, a prolapse of the uterus is never recognized as a hernia.

CAUSES OF HERNIA

In all cases of hernia there must first be a gap in the muscle wall and fascia, and, as has been seen, these gaps are many In congenital hernias there is already a small sac of peritoneum protruding through one of the gaps when the child is born. Many African children are born with an umbilical hernia, and some people in every race are born with a congenital inguinal hernia. The prevalence of inguinal hernia appears to vary not only with race but also with tribes, thus hernias are extremely common amongst coastal tribes in East Africa and round the Lakes, but they are rarely seen in Nairobi. This must be due to anatomical differences and not to climate or diet.

A hernia in other sites is often preceded by a small protrusion of extraperitoneal fat which worms its way into the small gap in the muscles and is then followed by a peritoneal sac. A hernia will grow bigger either because the muscles round the gap are weak or because there is increased tension in the abdomen. The increased tension in the abdomen may arise from straining at work, an increase of fat in the abdominal cavity a chronic cough, or straining to pass urine in cases of urethral obstruction.

If an elderly man has a hernia he should always be examined in order to exclude prostatic disease, as there will be a poor chance of permanent cure if his urinary obstruction is not corrected.

SPECIAL SITES

The inguinal hernia is by far the most common. It usually occurs in men and the reason for this is obvious, but it may also occur in women. Women also have an inguinal canal which contains a small band of tissue passing from the ovary to the skin of the labia, just like the band which passes from the testicles to

the scrotum in a male foetus. This band becomes attached to the uterus and is known as the round ligament of the uterus

In the female the gap in the muscles can be completely closed at operation, but in the male the canal must be preserved so that the vessels, nerves and vas can pass through Very careful repair must be carried out in order to leave as small a gap as possible, so that the chances of recurrence will be slight.

Umbilical hernia This is a congenital condition which exists in a very high proportion of African babies and in a number of European babies The edge of the hernia is a hard ring of fibrous tissue, and this is so firm that it very rarely grows bigger, in fact it usually contracts The fact that one scarcely ever sees an adult with an umbilical hernia proves that the great majority heal themselves.

An epigastric hernia is a different matter It arises in adults, in the middle line between the umbilicus and the xiphisternum, often just above the umbilicus. Very often the patient reports when the hernia is very small indeed, in fact there may only be the preliminary knob of fat projecting through the muscle layer This fat can become pinched and bruised and swollen, and so give rise to pain. Such cases are easily treated by operation

A hernia close to the umbilicus may grow to quite a large size and draw the umbilical skin upwards over it. These hernias are usually called umbilical hernias although they do not actually come out through the umbilicus. The contents frequently include the transverse colon instead of the small intestine, and, as the large intestine has infected contents some mild infection frequently occurs, with adhesion of the intestines and omentum to the walls of the hernial sac.

A femoral hernia arises at the upper end of the thigh, just *below* the inguinal ligament. It is often difficult to distinguish between an inguinal and a femoral hernia unless the ligament is very carefully palpated A femoral hernia is more common in women than in men because of the broader shape of the female pelvis which gives more room under the inguinal ligament.

SIMPLE REDUCIBLE HERNIA

Signs and symptoms

A simple hernia is a swelling which is obviously connected with the abdominal cavity

In the early stages it is usually reducible that is to say its contents can be returned fairly easily into the abdominal cavity The sac is still there, however, and the hernia easily recurs

The contents are usually bowel and so they feel slightly cystic, but they may be a solid lump of omentum which will feel more firm.

The hernia usually grows slightly bigger when the patient coughs, and this 'impulse' may be felt by the examining hand or finger

A very small inguinal hernia may only be felt by inserting a finger into the loose skin of the scrotum and passing it up over the inguinal ligament as far as the external inguinal ring An impulse may then be sought by asking the patient to cough.

Treatment

Simple hernias should be treated by operation. The contents of the sac are returned to the abdomen, the sac is removed right at its origin, the peritoneum is closed, and the gap in the muscle and fascia carefully repaired. It is more important to repair the fascia than any other layer Special belts, called trusses, can be bought to control a hernia, but they do not cure the condition and they must be worn whenever the patient is out of bed. The muscles around the hernial orifice may actually be weakened by the constant pressure of a truss

A truss should only be advised if a patient is either unfit for operation or resolutely refuses to have one.

IRREDUCIBLE HERNIA

In some patients it will be found impossible to reduce the hernia. This may be because the patient has such a large hernia and has grown so fat that there is little room left in the abdomen for the hernial contents. It is always possible, however to find room for even the largest hernial contents if open reduction is carried out by operation

In other cases the hernia becomes irreducible because there have been attacks of mild or severe infection in the sac, and the contents have become fixed to the wall of the sac. In these cases the adhesions will have to be separated at operation before the contents are returned but it may not be possible to loosen

the sac itself from the scrotal tissue and cord without causing excessive bleeding The sac can then be divided where it arises from the abdominal cavity the inner end closed and the outer part left in the scrotum. The muscle gap is closed in the usual way

The last cause of an irreducible hernia is strangulation, and this will be dealt with separately

SLIDING HERNIA

It was pointed out, at the beginning of the chapter that all the abdominal contents lie originally between the peritoneum and the muscle wall of the abdomen. The caecum, ascending colon, descending colon and bladder remain against the muscle wall, so that they are covered with peritoneum on one side only

One must now imagine a large hernia, consisting of a large sac of peritoneum. As the sac grows bigger it will gradually draw more and more peritoneum through the muscle gap You can see how the peritoneum on the posterior part of the sac can drag down the caecum and ascending colon on the right side, while the peritoneum of the medial wall of the sac may drag in the bladder to form one wall of the hernia.

When these organs are drawn through the muscle gap the surface not covered by peritoneum slides down along the muscle wall of the abdomen. Hence the name sliding hernia

During the repair of a sliding hernia, the loops of small intestine are returned to the abdomen, then the caecum, bladder or colon must be slid back to their proper places before the remains of the sac are divided and removed.

STRANGULATED HERNIA

A hernia becomes strangulated when the blood-supply to the enclosed intestine becomes partially or wholly cut off

A strain may have sent in an extra loop of intestine or the loop already in the sac may have become inflamed or else injured so that it swells slightly

The swelling gives rise to sufficient pressure at the hernial ring for the veins to be compressed. As blood can enter but cannot leave the strangulated intestine the swelling will increase further Soon the hernia becomes irreducible and then as

swelling increases, the pressure rises even higher until the arterial blood supply is cut off also This will be followed by gangrene of the bowel The bowel may then perforate.

Cases of gangrene of the bowel which have led to perforation are not often seen It takes a few days for the infected, gangrenous bowel to give way, and by this time the patient has usually either had treatment or has died of intestinal obstruction.

Signs and symptoms

The patient is always aware when his hernia has begun to strangulate. The normally painless hernia suddenly becomes tense and acutely painful and the pain steadily increases He attempts to reduce the hernia but may fail to do so If the hernia is reduced for him at this early stage all will be well, but if reduction is not carried out the next stages will follow

Stage 2 Intestinal obstruction develops. Colicky pain is experienced, the patient vomits and the abdomen begins to distend. As the distension increases the vomiting and colic will increase (see Chapter 26)

Stage 3 The bowel becomes gangrenous. This does not give rise to any particular sign of its own but will give rise to signs of infection as the gangrenous loop of gut becomes invaded with organisms from the bowel. There will be a rise of temperature and an increase in local tenderness. If the case is left long enough, a local abscess may develop More serious than this is the fact that the infection can spread back to the general peritoneal cavity giving rise to a general peritonitis and then to a paralytic ileus. By the time this stage has been reached there is little hope of saving the patient.

Treatment

A strangulated hernia is a surgical emergency It is one variety of acute abdomen

The actual treatment given will depend on the stage at which the patient has been seen. If the strangulation is very recent it may be possible to reduce the hernia. The patient is laid down and the hernia compressed with the hand. Pressure is applied mostly to the inner end of the sac in order to try to reduce first the piece of intestine which appeared last. One must remember however that the patient is already in pain and the bowel has

already been damaged. Only one or two attempts should be made to reduce the hernia and very strong pressure must *NEVER* be used.

If immediate reduction is not possible, the patient is admitted to the ward and given one-quarter grain of morphine. The foot end of the bed is raised on blocks the operating theatre is prepared and the patient shaved and prepared for operation

At the end of half an hour it may be possible to reduce the hernia, and the operation can then be postponed to a more reasonable time. Again, very strong pressure must *NOT* be used *for fear of damaging the bowel further* and the attempt must not be repeated more than once or twice.

The patient may be seen in an isolated spot where there are no operation facilities available. In this case he should be given morphine and sent to hospital with the foot of the stretcher raised the hernia *may* reduce itself before he gets there.

When distances are very great and no transport is available, all that can be done is to give the patient a spinal anaesthetic. This will completely relax the lower abdominal muscles and reduction may then be possible.

At operation the hernial sac will be opened and the gut inspected. *If it shows signs of early gangrene a portion of the gut will be removed*—this is known as a resection of the bowel When a resection has been carried out the patient will require gastric suction for a few days after the operation and will require to receive his nourishment by an intravenous infusion.

Stage 2 The patient may not have been admitted until intestinal obstruction has already commenced. If there are any signs of intestinal obstruction *NO* attempt must be made to reduce the hernia. Attempts at closed reduction will only increase the damage to the bowel and may drive infection into the abdomen.

The patient must be prepared for operation at once. This preparation must not be just a preparation of the skin, but must include the passage of a gastric suction tube and the setting up of a drip Saline will be given first, but one must watch the quantity of saline given and avoid giving the patient too much salt.

Stage 3 By this time the patient has passed from intestinal obstruction to paralytic ileus. *A simple incision of the hernial sac may be made to puncture the bowel and allow it to drain.* This can be done under a local anaesthetic. The rest of the

treatment will be that of paralytic ileus and infection (Chapter 26)

RICHTER HERNIA

This is a special variety of hernia which is sometimes met with. Only a small knuckle of bowel has entered the sac and only one edge of it is strangulated.

There is only a very small hernial tumour which may look like an inguinal adenitis Intestinal obstruction is incomplete, as the bowel contents can pass through the portion of bowel that has not entered the sac, and so the patient may have only slight colic and possibly no vomiting

The strangulated knuckle, however will become gangrenous if surgical treatment is not given, and the gangrene may lead either to a general peritonitis or to a local abscess. This abscess may burst through the skin or be incised, and a faecal fistula will then develop

The patient will require treatment for infection and then, when this has subsided the fistula can be closed.

STRANGULATION OF THE RE ENTRANT LOOP

This is another special variety of strangulated hernia which must be looked for during operation. When two separate loops of intestine lie in a hernial sac there must be a third loop which joins them together lying inside the abdomen. This is called the re-entrant loop

The mesentery of the re-entrant loop may have been dragged into the hernial sac and be strangulated, and the loop hidden inside the abdomen can become gangrenous, while the two loops found inside the sac remain healthy When two loops are found in a hernial sac, at operation, the in between loop must always be drawn out and inspected in case resection may be required.

CHAPTER 30

THE UPPER BOWEL

THIS chapter excludes injuries to the bowel and herniation of the intestine, as these are dealt with in separate chapters.

THE STOMACH AND DUODENUM

PEPTIC ULCERATION

Ulcers in the stomach and duodenum are relatively uncommon amongst African patients, but they are appearing with increasing frequency now that the Africans are being exposed more to the stress and strain of modern life. The same tendency has already been noted with regard to thyrotoxicosis and it also applies, curiously enough, to acute appendicitis. The latter condition may be due to a change in diet but this does not appear to be the sole cause

The student is referred to text books of medicine for the signs symptoms and medical treatment of peptic ulcers.

Surgical treatment is only required if a case fails to respond to medical treatment or if complications develop Medical treatment may be persisted with for a longer time if the ulcer is in the duodenum and not in the stomach because it is known that gastric ulcers may become malignant while it is believed that this does not occur to duodenal ulcers Surgical treatment is indicated if symptoms in gastric ulcers are unrelieved within six months of starting treatment.

If an operation is carried out for persistent ulceration, a very large part of the stomach is usually excised (subtotal gastrectomy) This will remove the part of the stomach which produces hydrochloric acid and it will cure duodenal as well as gastric ulcers An alternative operation is a gastro-enterostomy in which an opening is made between the lowest part of the stomach and a loop of small intestine. This operation carries the risk that a fresh ulcer may begin at the stoma, or junction and for this reason the operation has been largely given up in

young patients, in Europe. A number of these operations have, however recently been done at Kampala without a stomal ulcer forming but not enough of them have been done yet to show whether the operation will be permanently satisfactory

Complications

The surgical complications are perforation, haemorrhage and stenosis.

Perforation Perforation of an ulcer develops when the ulcer eats its way right through the wall of the stomach and then bursts into the peritoneal cavity

The condition has already been referred to in the chapter on the acute abdomen

The patient may give a past history of chronic abdominal pain but he may give no such history at all the sudden severe pain of the perforation being his first symptom.

The pain is *extremely* severe the patient may be restless with the pain but it is much more likely that he will hold himself absolutely still, possibly pressing his hands on his upper abdomen. On examination the abdomen will be found to be completely rigid and drawn inwards by muscle spasm

The patient should be put to bed and a surgeon called immediately If the patient is seen at an out-station he must be rushed to a surgeon as soon as possible.

While the patient is waiting to see the surgeon, a No 10 gastric tube should be passed in order to aspirate the stomach, and an intravenous drip set up The patient can then be given 500 000 units of soluble penicillin intravenously into the drip *NO* morphine, however should be given if a surgeon is likely to be able to see the patient in less than three hours.

The case will be treated by operation. The abdomen will be opened and the perforation repaired. Post-operatively the patient will continue with gastric suction and intravenous fluids and will receive penicillin until there is no further danger of paralytic ileus from peritonitis.

There is a very good chance of recovery if the operation is carried out within six hours from onset, but every hour of delay will lessen the chances

If the patient is not seen until very late, it will be wiser not to operate. If the patient has survived for more than two days it is

probable that the leak was small and that the body's defences in the peritoneum have been able to localize the peritonitis and seal off the leak. These cases will probably require treatment for paralytic ileus by gastric suction and intravenous replacement of fluid, as well as antibiotics to control the infection

Haemorrhage As a peptic ulcer penetrates the wall of the stomach or duodenum it may erode the wall of a large blood vessel. This will give rise to a serious haemorrhage into the interior of the bowel.

The patient becomes shocked and collapsed at the time of the haemorrhage. The blood may collect in the stomach and be vomited as a haematemesis or it may pass down the bowel In the latter case it becomes darker in colour and is passed as a large, black, tarry stool. This is known as melaena. If the haemorrhage is very severe the blood may travel very rapidly through the bowel and be very little altered when it is passed out, but this is unusual.

In the majority of cases the haemorrhage will cease if the case is treated medically but the physician should ask a surgeon to see the case as soon as it is admitted so that they can co-operate in the treatment. Thus the surgeon will be able to watch the progress of the patient and, if it is agreed that operation has become desirable, to arrange with the physician for operation to be carried out before it is too late.

On admission the patient must be given morphine and kept at rest. The blood he has lost should be replaced by blood transfusion, and particular attention must be paid to the restoration of fluid in order to avoid dehydration. A dehydrated patient will stand an operation badly Some physicians advise that the stomach should be kept empty the patient is given only ice to suck, and the rest of his fluid requirements are given intravenously Other physicians maintain that the only way to keep a stomach at rest is to fill it and they advise liberal feeding of the patient with soft foods

Operation is advised if the patient has one or more severe haemorrhages after medical treatment has been started operation is usually advised earlier in older patients, as old people do not survive prolonged or repeated bleeding It is a mistake to persist with conservative treatment until the patient has lost so much blood and is so dehydrated that he is not in a fit state to withstand the operation.

In hospitals where the surgeons do a large number of stomach operations, the surgeon may do a speedy partial gastrectomy, removing a large part of the stomach both to stop the bleeding and to prevent further peptic ulceration. In other hospitals it is considered safer simply to find the bleeding point and control the haemorrhage

Stenosis

A chronic peptic ulcer may repeatedly break down after healing Each time it heals it will heal by scar tissue and, if the ulcer is close to the pylorus this may eventually cause pyloric stenosis A portion of bowel is said to be stenosed when its interior has been narrowed.

Pyloric stenosis will not be complete to start with. Food will be able to get through but only after a long delay The stomach becomes chronically distended and splashing sounds may be heard if the patient is shaken some hours after a meal Fish is particularly likely to stick in the stenosed part of the bowel, as the fibres of the fish become matted together

If the patient takes another meal before the last meal has passed through there may not be room for the food and he may vomit it.

The patient tends to become thin and anaemic from malnutrition.

The only treatment for stenosis is by operation, but some time should first be spent in preparing the patient. He should only be given soft foods and the stomach should be emptied and washed out every evening in order to prevent stale food from lying in the stomach and fermenting overnight. Plenty of fluids must also be given in order to correct dehydration.

Most of the patients with stenosis are elderly and the activity of their peptic ulcers has died down. In these cases it is usual to do a simple gastro-enterostomy without there being any serious risk of a stomal ulcer forming

CONGENITAL PYLORIC STENOSIS

Some children, especially boys are born with a very powerful pyloric sphincter which gradually stenoses the pylorus. This prevents the passage of food from the stomach into the duo-

denum, especially some three or four weeks after birth. By this time the muscle has become very thick indeed, and it may even be felt as a tumour in the upper abdomen.

The child begins to vomit after meals and it does so with very great force. If the abdomen is watched waves of peristalsis may be seen passing across the stomach after a feed, trying to push the milk on. The waves pass backwards and forwards until suddenly the oesophagus opens and the food is projected up and out of the mouth. The force may be so great that the vomit is thrown several feet away This is known as projectile vomiting

Drugs of the atropine type may be given in an attempt to relax the muscle but the best treatment is by operation. The abdomen is opened and the thickened muscle is found. The muscle is divided without opening the mucosal lining of the stomach or duodenum, and the abdomen closed. The child may be given small feeds of diluted milk within a few hours of the operation, and complete recovery rapidly occurs

Treatment will be made much more difficult if the patient has been allowed to become severely dehydrated before operation.

CARCINOMA

Apart from cancer of the skin, cancer of the stomach is one of the most common cancers in the male. It occurs in females as well, but is not so common in them as cancer of the cervix or the breast. Cancer of the duodenum is very rare in either sex.

The tumour of the stomach is an adenocarcinoma It occurs most often after the age of fifty although it can occur before then. In the early stages the tumour ulcerates through the mucous membrane and causes slight bleeding which will only be found if tests are made for occult blood in the stool

There may be no pain at first, but the patient becomes tired anaemic and weak and may have slight indigestion Later the tumour may enlarge enough to become palpable through the abdomen or the patient may feel ill enough to consult a doctor The doctor may miss the diagnosis and it may be several months more before the patient is sent to a surgeon as a possible case of carcinoma.

By this time the tumour has often spread to the lymphatic glands and possibly to the liver In a large number of cases

once the abdomen has been opened, it will be found quite impossible to remove the growth The patient may then be made more comfortable, if there has been stenosis by a gastro enterostomy Even when the tumour can be removed with all the lymphatic glands the results are very poor In countries with very highly developed medical services not more than 10 per cent. of patients who develop cancer of the stomach are alive at the end of five years

SMALL INTESTINE

The small intestine is subject to very few diseases It may be injured by a stab or bullet wound it may be ruptured by a crushing injury and it may perforate as a result of typhoid fever The only other probable pathological conditions are paralytic ileus and intestinal obstruction.

Paralytic ileus has its greatest effect on the small intestine (Chapter 28) *obstruction* may appear anywhere in the intestinal tract from the upper end of the oesophagus to the anus. In the small intestine it is usually sudden and complete, and it is often accompanied by strangulation of the bowel

Causes of small intestine obstruction

Strangulated hernia See Chapter 29 This is the commonest cause of intestinal obstruction and strangulation.

Intussusception. Neither intussusception nor volvulus is common, but cases are seen every now and then Intussusception occurs most frequently among young infants but several cases have been reported in Africans between the ages of ten and fifteen. It does occur very very rarely in adults, and in these cases there is often a benign tumour present in the small intestine.

In children the cause appears to be a lack of co-ordination in bowel peristalsis As a result, a small portion of the bowel contracts into a small lump and actually enters the portion of the bowel below it. The bowel below treats this lump in the same manner as a lump of food it promptly grips it and passes it on farther down the bowel. In this way the bowel gradually disappears inside itself

This usually happens at the lowest part of the small intestine,

and the 'invaginated' portion passes into the caecum, up the ascending colon and possibly round into the transverse or even the descending colon. As the head of the intussusception passes on it will drag in more and more bowel after it, and it will also drag in its own mesentery

The mesentery soon becomes compressed and the invaginated portion of the intussusception begins to swell this will soon be followed by strangulation of the bowel.

The first symptoms are those of early obstruction. The child has attacks of severe colicky pain during which it screams and rolls about in the bed It may vomit at the outset, and the peristalsis will cause the bowels to empty (It should be noted that the bowels are *frequently emptied by peristalsis at the onset of any* form of obstruction and that constipation does not appear until later)

On examination of the abdomen, at this stage, there will be very little distension, but it may be possible to feel the intussusception as a tumour lying in the right iliac fossa, especially as it begins to harden during a wave of peristalsis. As the condition progresses the tumour becomes bigger and moves up and across the abdomen.

The congested mucous membrane secretes mucus and this will be tinged with blood. Quite large quantities of mucus may be secreted and passed out of the anus appearing like small lumps of red jelly *This red jelly is a very characteristic sign of an* intussusception but treatment should not be delayed because it has not yet appeared.

As the obstruction increases the abdomen begins to distend, owing to the collection of gas and fluid in the bowel. The obstruction is low down in the intestine, and so distension may become quite marked before the vomiting of obstruction begins. Once vomiting starts it will be continuous and violent—very different from the effortless vomiting which is seen in paralytic ileus

The invaginated portion of bowel will eventually become gangrenous, but this may not give rise to peritonitis and paralytic ileus, *because the gangrenous portion of the bowel is tucked* inside the bowel below and is far away from the peritoneal cavity

The *diagnosis* will be suspected if there is any suggestion of intestinal obstruction in a young child and there is no sign of a

strangulated hernia. The treatment is by urgent operation The abdomen is opened and an attempt is made to reduce the intussusception. If the invaginated portion is gangrenous it will have to be resected resection will also be necessary if it is not possible to reduce the intussusception.

Operative treatment is accompanied by gastric suction intravenous fluids and the injection of penicillin, if indicated.

Volvulus A volvulus is a twisting of the bowel round itself If you open an abdomen and pick up the intestines in your hands you can twist them right round on their mesentery This will be very much easier if the mesentery is long as in the pelvic colon, but it will not be so easy in the small intestine.

Volvulus of the small intestine is extremely rare. It is so rare that it is not usually mentioned at all in surgical text books It is mentioned here because in some districts of Africa and India it is by no means uncommon. Whether this is because the people of these areas have different eating habits or because the mesenteries are longer is unknown. In Nairobi, in 1945 volvulus of *the whole* of the small intestine was one of the commonest causes of intestinal obstruction, six cases being seen in one year

The twisting of the mesentery causes rapid strangulation of the bowel. Pain is intense. At first it is colicky but it rapidly becomes continuous as the obstructed bowel allows infection to pass through and peritonitis begins.

The treatment is urgent laparotomy The bowel is untwisted and the abdomen closed. As the distension is so great it may be necessary to puncture the bowel and empty it of fluid and gas before the abdomen can be closed. Gastric suction, intravenous fluids and penicillin will be esential both before and after the operation

Other causes of obstruction

The bowel may sometimes be obstructed by bands of fibrous tissues or adhesions. Some of these bands are congenital, others are secondary to acute or chronic peritonitis especially tuberculous peritonitis. Strangulation may occur if a loop of bowel gets under the band or adhesion.

The bowel may also be obstructed by the impaction of a mass of intestinal worms.

In obstruction, without strangulation the patient suffers

from colicky pain distension and vomiting Strangulation, if it does occur is soon followed by peritonitis, gangrene of the bowel and paralytic ileus

Treatment, whether strangulation is present or not, is by urgent operation after suitable preparation.

Summary

Intestinal obstruction is an urgent emergency It is characterized by severe colicky pain, followed by abdominal distension and vomiting In most cases an irreducible hernia will be present, but there are some other causes which may not be obvious at first.

If obstruction is suspected an intravenous drip should be set up and the stomach repeatedly emptied by a gastric tube while preparations are made for operation

THE APPENDIX

The appendix is a small organ lying in the right iliac fossa, attached to the lower end of the caecum.

Infection of the appendix is known as appendicitis. The exact cause of this disease is unknown it is very uncommon amongst Africans living in the country and eating their own natural diet but it is becoming more common amongst Africans in large towns This may be due to a change in diet or it may be due to mental worry causing an increased spasm of the bowel. When appendicitis does occur it often appears as a small epidemic, suggesting that it is caused by a particular organism.

Appendicitis may be mild (subacute) or very severe.

Subacute appendicitis

This is the variety most commonly seen in East Africa in any race. The patient feels slight colicky pain round about the umbilicus this suggests some irritation of the middle section of the bowel and might be due to gastro-enteritis, especially if the patient vomits as he frequently does

Inflammation has begun at this stage and the first rule in the treatment of inflammation is to rest the part. In these cases a purgative should never be given, as this may increase the

activity of the bowel and convert the appendicitis from a sub acute infection to an acute one.

There is a slight rise in temperature, rarely above 101°, and a general feeling of illness.

As the inflammation extends in the appendix it will reach the peritoneal coat and cause pain in the right iliac fossa from local peritonitis. It is very characteristic for the pain to start near the umbilicus and then, after six hours or so, to shift to the local area.

After a few days the inflammation may subside completely leaving no trace of infection. Other patients may have repeated attacks, and there is a danger that one of these attacks may prove to be severe.

Treatment Adults with subacute appendicitis may be treated conservatively They are allowed fluids only by mouth, and the bowel is rested by giving the patient morphine. Morphine should not, however, be given until the patient has been seen by a surgeon.

The infection can be treated by a course of injections of penicillin but it is advisable to give sulphonamide drugs as well because many organisms in the bowel are more sensitive to sul phonamides than they are to penicillin

Four to six weeks after the attack, the appendix should be removed in order to avoid the risk of further attacks.

It is not safe to treat children conservatively because the infection is likely to become acute very quickly Any child who shows the signs and symptoms of appendicitis should have his appendix removed as an emergency operation.

Acute appendicitis

Pathology In severe appendicitis the organ rapidly becomes grossly inflamed. The onset of umbilical pain and vomiting is more abrupt, the pain moves to the right iliac fossa more rapidly and peritonitis develops more quickly than in the subacute disease. The peritonitis may be localized by the peritoneal defences or it may be so severe that a general peritonitis develops.

The appendix may be obstructed by a small quantity of faeces which block its lumen, or the local infection may cause throm bosis of the blood vessels. In these cases the appendix may become gangrenous and then rupture. If this occurs there will naturally be an increased risk of general peritonitis.

If a severe appendicitis is left untreated, one of three things may happen. The infection may resolve or a general peritonitis may develop with the risk of paralytic ileus, or the peritonitis may become localized. If a local peritonitis develops a tumour composed of adherent bowel and omentum will be formed in the right iliac fossa this will not be fully formed for forty-eight hours, and there is always the risk before then that the infection may break out of the barrier that is being built around it and give rise to a late general peritonitis.

Some patients are not seen until forty-eight hours from the onset some of these will have a general peritonitis with paralytic ileus others will already have developed the tender mass of a localized peritonitis The latter cases are developing an 'appendix abscess which may resolve or may require incision and drainage. The abscess is not really an appendix abscess although that is the name that is given to it. It is really a peritoneal abscess surrounding the infected, and possibly gangrenous appendix.

Treatment If an adult patient with severe appendicitis is seen within forty-eight hours of the onset, he should be treated by immediate operation for removal of the appendix. The operation will be preceded and followed by a course of penicillin and sulphonamides. If severe general peritonitis has already commenced then gastric suction and intravenous fluids will also be required.

If the patient is not seen until more than forty-eight hours after onset the treatment will depend on the clinical findings.

When there is a general peritonitis and paralytic ileus has started, the patient should be treated by rest morphine penicillin, sulphonamides (by injection) gastric suction and intravenous fluids. If he survives a local abscess will probably form either in the right iliac fossa or in the pelvis.

When the patient comes in with a local tumour in the right iliac fossa, operation should definitely be postponed. An operation at this stage may break down the defensive wall that the body has formed and allow general peritonitis to develop

The patient is treated conservatively Fluids only are given by mouth sulphonamides and penicillin are prescribed and the patient is watched carefully The pulse is recorded hourly, the temperature is taken four hourly and the abdomen is examined gently but repeatedly Morphine may only be given in small doses in order not to hide any extension of the disease.

The disease occasionally resolves completely, but a local abscess usually forms

General spread outside the local area sometimes occurs, even at this late stage, and this may necessitate treatment of paralytic ileus. If a local abscess forms, it will have to be drained after some days of conservative treatment this should be done over the lower part of the tumour, above the inguinal ligament, or on the flank at the side of the tumour well clear of the general peritoneal cavity No attempt is made to remove the appendix, and very great care must be taken not to open the general peritoneal cavity

After resolution of an acute appendicitis or after the drainage of an appendix abscess an operation will be required later for removal of the damaged appendix. This should not be done for at least four months, in order to allow all the local infection to subside.

Summary of treatment

Subacute appendicitis

Adults Treat conservatively

Children Emergency operation required.

Acute appendicitis

Less than forty-eight hours from onset emergency operation required at all ages together with treatment for peritonitis.

More than forty-eight hours from onset usually treated conservatively either for general peritonitis with paralytic ileus or for local peritonitis. In the latter cases an appendix abscess may need to be drained.

Late removal of appendix

After four to six weeks in subacute cases after four to six months if a local peritonitis or abscess has been treated

CHAPTER 31

THE LOWER BOWEL

THE CAECUM

THREE diseases occur in the caecum and they are all characterized by the formation of a tumour. They are tuberculosis, amoebiasis and cancer giving rise to a tuberculoma, an amoeboma or a carcinoma. All three of these conditions must be remembered when a patient has a palpable lump in the right iliac fossa for the treatment of each condition will differ. Two other conditions unconnected with the caecum, may also give rise to a lump in the right iliac fossa namely a localized peritonitis or abscess from appendicitis and a deep inguinal adenitis.

The three caecal diseases are comparatively easily distinguished from the other two conditions as they are all chronic diseases with a slow onset and unless there is secondary pyogenic infection, they give rise to very little pain. Both a deep inguinal adenitis and a local peritonitis are acute and painful.

Tuberculosis of the caecum

This condition is not very often seen. The disease involves the caecum, the neighbouring part of the small intestine and the beginning of the ascending colon.

The patient is vaguely ill and, as in tuberculosis elsewhere his general health deteriorates. Later a palpable tumour will be felt and later still intestinal obstruction may develop. The patient may have diarrhoea with blood and mucus in the stools and tubercle bacilli may be found in the faeces but final diagnosis may not be made without operative exploration.

Amoeboma

An amoeboma is a tumour resulting from chronic amoebic dysentery. It appears as a slightly tender lump and there may be blood and mucus in the stools. Stool examination may show entamoebae to be present.

Sometimes the amoeboma becomes secondarily infected with pyogenic organisms that give rise to acute pain in the right iliac fossa. This may lead to a mistaken diagnosis of appendicitis It is most unwise, in the presence of amoebiasis to remove the appendix. If there is any doubt about the diagnosis it is safer to treat the case conservatively and give a course of emetine injections.

If the diagnosis has been made correctly the condition can be cured by giving penicillin and sulphonamide drugs for the secondary infection and by treating the amoebiasis with emetine or other drugs.

Carcinoma

The caecum is one of the common sites for carcinoma of the large bowel The other common sites are the rectum and the pelvic colon, but the disease may also appear elsewhere in the colon

In the caecum the tumour frequently ulcerates through the mucous membrane into the interior of the bowel. It then becomes infected and bleeds. There may not be any constipation or diarrhoea at first, but the patient will have vague indigestion he will be anaemic from the bleeding and toxaemic from the septic infection. The bleeding is not usually profuse and is usually only shown by the presence of occult blood in the stool

Untreated cases gradually develop obstruction.

Treatment

Any patient with a tumour in the right iliac fossa should be admitted to hospital for investigation. The stools should be examined and the patient may be X rayed after a barium meal. Amoebiasis is treated medically Tuberculosis is treated conservatively at first but may require operation later while carcinoma must be treated by operation.

Obstruction by tuberculosis or carcinoma is treated by joining the lower end of the ileum to the transverse colon (ileo-transverse-colostomy) in order to allow the contents of the bowel to pass on.

Operable cases of carcinoma and some cases of tuberculosis will be treated by removing the affected area after carrying out an

ileo-transverse-colostomy The operation may be carried out in one or two stages.

TRANSVERSE AND DESCENDING COLON

Almost the only disease which occurs in this part of the body is carcinoma. Here the carcinoma is unlikely to ulcerate in the early stages, but it forms a hard ring round the bowel and gradually causes obstruction. The clinical picture and treatment of large bowel obstruction are described below

PELVIC COLON (SIGMOID COLON)

The pelvic colon lies in the left iliac fossa. As in the caecum, an amoeboma may develop and this must be distinguished from an infected malignant tumour Carcinoma is not uncommon, especially at the lower end where the colon joins the rectum. As in the bowel immediately above and below the carcinoma usually takes the form of a ring stricture and gives rise to gradual obstruction.

The pelvic colon may also be acutely obstructed by a volvulus of the bowel (see p 283)

THE RECTUM

The rectum begins in the middle line of the body at the recto-sigmoid junction, and it ends just above the anus.

It cannot be examined by abdominal palpation, but at least three inches of it can be examined by a finger inserted gently into the anus The remainder of the rectum and most of the pelvic colon can be examined by means of a sigmoidoscope passed into the rectum from below

If disease is present in the rectum it can be seen by sigmoidoscopic examination this may show the ulcers of dysentery or the tumour of a carcinoma or an amoeboma. A small portion of the tumour can then be removed for pathological examination.

OBSTRUCTION OF THE LOWER BOWEL

We have seen that carcinoma anywhere in the lower bowel will cause obstruction and that this may also be caused by the rare tuberculosis of the caecum. Obstruction in the caecum has the

same effects as obstruction of the small intestine (Chapter 30), it is usually accompanied by a palpable tumour in the right iliac fossa.

Obstruction below the level of the ascending colon is almost always due to carcinoma. We have seen that a malignant tumour in this area grows slowly, and that it takes the form of a ring which slowly constricts the bowel. Obstruction is slow to develop and is usually incomplete, or chronic, for a long time before total or acute obstruction occurs

Sudden, acute obstruction may however occur in an otherwise healthy individual as a result of *volvulus* of the pelvic colon. The pelvic colon is like the small intestine in that it is only attached to the posterior wall of the abdomen by a mesentery and, if the mesentery is unduly long the pelvic colon may become twisted upon itself In most countries volvulus of the colon is much more common than volvulus of the small intestine.

As in the small intestine, the twisted portion of bowel rapidly becomes strangulated. The large bowel can dilate very readily and a huge tympanitic tumour soon fills the abdomen. If the obstruction is not relieved promptly the obstructed bowel above the lesion will also dilate. The patient may vomit at the onset but the vomiting is not repeated because it takes a very long time for the dilatation to extend up as far as the stomach

A patient with volvulus of the pelvic colon is in severe pain, the large dilated loop of bowel will be obvious on abdominal examination, and the patient should have an immediate operation as a case of acute abdomen' Body fluids, lost into the distended bowel, must be replaced by an intravenous infusion, but it will not usually be necessary to start gastric suction unless the strangulation has been followed by peritonitis and paralytic ileus of the small intestine.

Chronic intestinal obstruction

A slow growing carcinoma gradually obstructs the bowel The patient may appear to be perfectly fit and well during the early stages, as there may be no ulceration of the tumour with resulting infection and toxaemia. He may however have attacks of constipation. The lower the obstruction in the bowel, the earlier these attacks will occur

The faeces held up above the obstruction irritate the mucous

membrane and may then give rise to some apparent diarrhoea, because of the passage of blood and mucus and portions of stool the constipation itself may be relieved by giving purgatives which stimulate bowel peristalsis and force the faeces through the narrow gap The purgatives may be taken by the patient himself or may even be ordered by a doctor or medical assistant who has not thought of the possibility of early cancer

This history of alternating constipation and diarrhoea is so characteristic of carcinoma that one must always be alert to detect it. When a middle aged patient reports that he, or she, has been suffering from attacks of constipation for a few months, and has never suffered that way before, he should be admitted to hospital at once for investigation. The same advice should be given to anyone who complains of repeated attacks of diarrhoea in middle or later life. These patients should not be treated with purgatives or other drugs in the out patient department without further investigation.

Investigation Every suspicious case should have a rectal examination at once. A finger will soon show whether there is a tumour in the last three inches of the rectum.

If the lesion is higher up a lump may be palpable through the abdominal wall, but it is not always possible to feel a small early tumour especially if the patient is fat.

The patient may next be examined by a barium X ray This will be done best by giving a barium enema The X ray may show that the barium is held up in some part of the lower bowel and cannot rise any higher in other cases the barium will flow through the stricture but some of it will remain above the stricture after the patient opens his bowels to evacuate the fluid. Another X ray taken a few hours later will show that some barium is still present.

Finally a growth in the rectum or pelvic colon can be seen through a sigmoidoscope and a portion taken for biopsy

Treatment When a malignant tumour has been diagnosed, it should be removed by operation. If the lesion is high up in the colon it may be possible to join together the two ends of the bowel but if the tumour is in the rectum this may be impossible. Then the colon above the tumour will have to be brought out on to the surface of the skin above the left inguinal ligament. This bowel opening is known as a colostomy and, in this case, it will be a permanent inguinal colostomy

Acute on chronic obstruction

Unfortunately a large number of cases of carcinoma of the lower bowel are not diagnosed in the early stages described above. They are not seen until the lumen of the bowel has been completely obstructed This may be due to the steady growth of the tumour, but it is more often due to oedematous swelling as a result of an attack of constipation.

A carcinoma grows so slowly in the lower bowel that even in these cases the results of treatment are quite good. They will of course, be hopeless if the liver has already been involved by secondary tumours or if secondary tumours are scattered over the surface of the peritoneum.

Symptoms and signs The symptoms and signs of acute obstruction following chronic obstruction of the lower bowel will be colicky pain constipation and distension. As there is no strangulation of the bowel there will not be any immediate peritonitis or paralytic ileus of the small intestine, and so vomiting will be rare.

The patient may seem fairly well he is able to take fluids and even solid food by mouth, but the distension grows steadily bigger, and the constipation and colicky pains persist.

The distension will consist of tympanitic bowel and will be most marked in the flanks and across the abdomen along the course of the colon. This condition may persist, untreated, for five or six or more days Eventually however the dilated bowel contents will become grossly infected, and toxins will be absorbed from the bowel into the circulation. A general toxaemia will develop and the patient will die. The end is hastened as infection spreads through the bowel wall to the peritoneum.

Treatment When acute obstruction has developed, in a case of carcinoma, it is not wise to remove the affected portion of bowel at once, and to try to sew the ends together unless the acute symptoms have been present for only two or three hours. It is much wiser to carry out a colostomy above the level of the growth This is frequently done in the transverse colon forming a temporary transverse colostomy

The bowel above the colostomy will be able to drain through the colostomy and the distension and the infection in it will be reduced. The swelling of the tumour from oedema will also subside, and both of these processes can be assisted by giving sulphonamide drugs and penicillin. The sulphonamides are more

useful than penicillin for infection with bowel organisms and succinyl sulphathiazole should be used. The dose is eight to twelve tablets to start with followed by four to six tablets four-hourly

When the patient has recovered from his toxaemia the abdomen may be explored again and the tumour treated either by excision and a permanent inguinal colostomy, or by suture of the divided ends of the bowel.

At a final stage the transverse colostomy can be closed.

THE ANUS

Imperforate anus

This is a congenital condition in which the anal canal of the child has failed to develop It may be noticed at birth, or perhaps not noticed till a few days later when the mother sees that no stools have been passed and that the abdomen is becoming distended.

Sometimes, in girls, the anus is closed, but there is a congenital fistula between the lowest part of the alimentary canal and the vagina.

If a fistula is present, the child may be left until she is five or six years old, when it will be easier to operate and correct the deformity

Cases with complete obstruction must be treated by early operation. The bowel always contains gas, and this gas will show on an X ray A metal object, such as a pin is strapped to the anus and the child is X rayed hanging *upside down* by its feet so that the gas will rise to the very end of the alimentary canal.

If the gap between the gas and the pin is small the child may be treated by an incision from below but if there is a large gap, showing that part of the rectum is missing also a colostomy will have to be done. It may be possible to construct a new rectum and anus when the child is older

Haemorrhoids anal fissure anal sinuses and anal fistulae

These conditions are all more frequent in patients who are subject to constipation The normal African diet results in a large soft stool constipation, and therefore these diseases, are uncommon

Haemorrhoids (*Piles*) Immediately inside the anus there are large veins which lie just under the mucous membrane. Normally these veins give rise to no trouble, but they may become swollen and distended if the patient strains to pass faeces, or sometimes if he strains to pass urine.

The distended veins may be bruised by the passage of a hard stool and may bleed. This stage is known as first degree haemorrhoids The piles do not project out of the anus, but they can be seen, enlarged and distended just inside the orifice if the anus is examined with a proctoscope. Chronic and repeated bleeding gives rise to anaemia.

The majority of patients can be cured by treating the constipation. They are given advice with regard to diet, being especially encouraged to take plenty of vegetables and fruit If a change of diet is not sufficient, they may take liquid paraffin regularly to soften the stools Half an ounce taken every night is usually sufficient

Persistent constipation may lead to second-degree piles or haemorrhoids. In these patients the distended veins have been stretched and pushed downwards by each act of defaecation until they appear outside the anus when a stool is passed. Bleeding again gives rise to chronic anaemia. Second-degree piles can be pushed back into the anus again by the patient's finger or they may return themselves and then stay there until the next act of defaecation.

In third degree piles the piles are so big that they remain permanently outside the anus and, if they are pushed back, they at once pop out again.

Second and third degree piles should be treated by operation for removal of the mass of varicose veins As an alternative they may be injected by special drugs, such as 15 per cent. carbolic acid in oil, to thrombose the blood in the haemorrhoid, but cure is not so certain as by operation.

Sometimes thrombosis occurs accidentally in piles that have come outside the anus The mass soon becomes swollen and very painful and cannot be returned into the anus—or if returned it comes out again at once The thrombosed piles frequently become infected, and immediate operation is not advised The patient is treated by cold compresses to the perineum, morphine to relieve pain, blocks at the foot of the bed to relieve congestion and penicillin for the infection. The mass will slowly shrink

with this treatment, and an operation can be carried out later to remove the haemorrhoids that remain

An *external pile* is a very small varicose vein lying under the skin just outside the anus It rarely gives rise to trouble unless it becomes thrombosed. In that case there appears a firm, very tender and painful nodule just beside the anus The pile may be incised under local anaesthesia and the clot of blood allowed to escape. This relieves the pain immediately and the wound will soon heal

Fissure in-ano

An anal fissure usually lies in the posterior part of the anus. It is caused by a constipated stool passing through the anus and tearing off a small piece of mucous membrane. The small ulcer causes severe pain and the anus is held tightly in spasm a tender area will be found in one part of the anal ring by the examining finger which is passed into the anal canal. If the anus is inspected, a small tag of skin may be seen below the fissure and, when the buttocks are held apart and the patient strains downwards, the tear in the mucous membranes may also be seen.

Treatment The stools are kept soft and the bowels opened regularly by giving the patient liquid paraffin A small, early fissure may heal by itself more severe ones will heal if the tissue underneath is injected with procaine dissolved in oil (e.g 'Proctocaine') to relieve spasm. A chronic fissure, however, will have to be treated by surgical excision

Ischio-rectal abscess anal sinus and anal fistula

Damage to the anal mucous membrane may allow infection to pass through the walls of the anus to the fatty pad of tissue lying between the anus and the ischial bone of the pelvis This area of soft tissue can be felt between the bones on either side of the anus.

The infection may resolve by itself or with treatment, or it may progress and form an abscess. An ischio-rectal abscess as this is called, should be incised as soon as pus has formed The incision is made over the most tender spot, and the skin on each side of the incision is excised in order to make a wide mouth to the wound the wound itself is packed with acriflavine in paraffin or with zinc iodoform paraffin paste (Z I P P)

The dressing is changed as frequently as is necessary, depending upon how much pus escapes past the dressing, each time the dressing is changed the wound is repacked and the pack must be inserted to the *bottom* of the wound If this is not done the skin may heal before the deep tissue heals and chronic infection will develop

If an ischio-rectal abscess is not incised or if the skin is allowed to heal over too quickly infection spreads through the surrounding soft tissue, and the abscess then has many twisting branches in amongst the fat.

Eventually the pus comes to the skin surface and discharges, and in this way an anal *sinus* is formed As the drainage hole is small the abscess does not heal quickly and it is constantly re-infected from the region of the anus and the surrounding skin. The fresh infection enters the mouth of the sinus and travels up into the abscess. This anal sinus may close from time to time and then break down again repeatedly The twisting abscess cavity will be surrounded in time by a dense barrier of fibrous tissue which reduces the blood supply to the infected area and eventually makes cure impossible by any means other than operation.

At operation the whole area will have to be excised. A portion of skin is removed from over the infected area and then all firm fibrous tissue is felt with the finger and excised If all the fibrous tissue is excised, then all the infection will have been removed with it. The cavity is packed with flavine in paraffin or with Z.I.P.P and the wound is treated in exactly the same way as after the incision of an acute abscess.

Fistula in-ano An anal fistula is formed in the same manner as an anal sinus only in this case the pus has found its way not only out on to the skin but also through the wall of the anus or rectum. The chronic abscess now has two openings and repeated infection will, of course, be much more common.

A fistula is treated in the same manner as an abscess or a sinus—by wide excision and packing In order to expose the inner opening it will be necessary to divide the anal sphincter and slit open the anus below the fistula. The pack will then be placed so that it fills the excised area of the ischio-rectal region and also fills the slit in the anus Very great care must be taken to see that the wound heals from the bottom or the condition will probably recur

It will be noticed that there are no fewer than five diseases of the anus (haemorrhoids, fissure abscess, sinus and fistula) apart from congenital abnormalities and tumours It must also be remembered that if the patient s complaint is of bleeding the blood may not be coming from the anus at all but from the rectum or large bowel higher up and the finger or a proctoscope or a barium enema may be able to reveal a carcinoma of the lower bowel at an early stage

These conditions *must* be carefully distinguished by proper examination. This can only be done by inspecting the anus passing a finger into it and then examining it with a proctoscope. If still in doubt, the patient *must* be admitted for investigation

Many a carcinoma of the rectum has been missed in the early stages because the patient has said he has 'piles and he has been given liquid paraffin or anal suppositories without a rectal examination being made.

Epithelioma

Skin covers the outer surface of the anus and also the first half inch of the anal canal. This skin is subjected to repeated irritation and, as a result, an epithelioma may develop

The epithelioma slowly enlarges and forms an irregular lump which may become infected and ulcerate.

The lymph vessels from the anus drain into the superficial inguinal glands, and these may become enlarged either from chronic infection or from tumour metastases

An epithelioma may be treated by excision or by radium, and the inguinal glands should also be removed surgically

probably liver damage in childhood, owing to protein malnutrition. A few years ago, when it was unusual to see old patients in East African hospitals carcinoma of the liver was one of the few malignant diseases seen (Other fairly common tumours which we still see, were epitheliomata following chronic ulcers and sarcoma of bone.)

A hepatoma gradually enlarges and presses on the portal venous system. This gives rise to poor drainage from the peritoneal cavity, and ascites develops This is later followed by oedema of the lower limbs. The liver will be enlarged, and hard nodules can be felt in it this will distinguish the condition from the smooth enlargement which follows heart failure but it may be difficult in the early stage to differentiate the condition from cirrhosis of the liver In cirrhosis nodules may also be felt, but there are usually many more of them and they are all small. In either condition it may not be possible to feel the liver at all until the ascites has been relieved by tapping

No treatment is available for a malignant hepatoma. The liver is an essential organ and so cannot be removed. The patient may however be made more comfortable by repeated aspirations of the abdomen. As a result of destruction of liver tissue, a steadily increasing jaundice frequently develops before death.

Secondary tumours The liver is the commonest site for the development of secondary carcinomata following malignant disease of the bowel.

The liver must always be examined when cancer of the bowel has been diagnosed, and it should be inspected or felt with the hand when the abdomen is opened for treatment of the primary cancer

Secondary tumours of the liver usually mean that the cancer is too far advanced for any hope of a permanent cure but, if there is only one secondary, it may be possible to excise it together with the surrounding portion of liver

THE GALL-BLADDER AND BILE-DUCTS

The bile secreted by the liver passes down the bile-ducts to the duodenum. Between meals it is stored and concentrated in the gall bladder which empties and pours bile into the duodenum when it is required for digestion.

The gall bladder however is not essential to life or for proper

towards the surface. It usually does this in an upward direction, it works its way through the upper part of the liver, through the diaphragm and into the lung It may then penetrate a bronchus the patient has a *sudden fit of coughing and brings* up a great quantity of pale reddish purple pus In other cases the abscess works its way towards the outside of the lung and, having penetrated the pleura, appears as a bulge on the right side of the chest.

If a spread to the lung is diagnosed before the abscess has burst into the bronchi the abscess can be aspirated and the case treated in the same manner as if the infection were still confined to the liver

The other conditions which may give symptoms very similar to those of an amoebic abscess in the liver are (i) a local peritonitis under the diaphragm (subphrenic abscess) and (ii) an abscess in the loose tissue around the kidney (perinephric abscess) *The diagnosis may be helped by an X-ray examination* which will show the position of the diaphragm, but final diagnosis may not be possible until after aspiration.

Hydatid disease The liver is the most common site for the development of hydatid cysts. They do not usually give rise to any symptoms until they are quite large the patient may then complain of a large tumour in the upper abdomen. On examination this tumour will be found to be attached to the liver and it is round and cystic.

In some cases it will be possible to excise the whole tumour *without breaking it. In other cases it will be necessary to open* the cyst after putting gauze packs all round it in order to prevent infection of the peritoneal cavity After all the fluid has been removed, the edges of the opening can be stitched to the edges of the skin, so as to make a wide sinus leading into the cavity The inner wall of the cyst can then be destroyed by painting it with formaldehyde.

Tumours

Benign tumours are rare in the liver Malignant tumours are either primary or secondary

A primary malignant hepatoma is much more common amongst Africans than amongst any other race. The tumours appear at quite a young age often before the age of thirty The cause is

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The gall-bladder however is not essential to life or for proper

digestion, and it may be removed if it is diseased Care must be taken to see that the bile ducts are not damaged during the removal.

The gall bladder is yet another organ which is rarely diseased in Africans

Cholecystitis

The gall bladder may become acutely inflamed The patient will have pain in the region of the gall bladder just under the ribs in the same line as the nipple There will be a rise of temperature and general signs of toxaemia, but these are not usually severe

The gall bladder rarely becomes gangrenous, and so conservative treatment is usually advised until the acute inflammation has subsided. The patient is put to bed and given morphine and local heat in order to relieve pain, and penicillin for the control of infection. When the acute symptoms have subsided the gall bladder may be removed

Gallstones (*biliary calculi*)

The exact cause of the formation of gall stones is not yet known. The common variety develop in the gall bladder but some, less common varieties may develop in the bile-ducts themselves.

The gall-stones may lie quite quietly in the gall bladder but more often they give rise to symptoms as the gall bladder tries to push them out with the bile when it empties

A large stone may stick at the neck of the gall bladder but smaller ones may enter the common bile-duct and stick there even smaller ones may pass right through into the duodenum.

When a gall stone becomes arrested in its passage, it will cause a painful distension of the gall bladder or bile-ducts, and the patient will have colicky pain as the muscular tube tries to push the stone onwards. The pain may be relieved as the stone passes on, or it may subside when the tube gets used to its presence and spasm relaxes If the stone remains in the bile-duct symptoms are liable to recur as the tube becomes repeatedly irritated and swells again causing a complete blockage of the passage of bile.

If the stone is in the bile-duct and not just in the neck of the gall bladder the blockage will not only cause the gall bladder to

Chapter 27
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A rare variety of tumour of the pancreas is a tumour of the islet cells which make insulin. A tumour of these cells produces an excess of insulin, and the patient will then have a low blood sugar and may develop fainting attacks from hypoglycaemia. If the condition is diagnosed the affected part of the pancreas may be removed.

THE SPLEEN

Infection and tumours of the spleen scarcely ever occur, apart from enlargement in Hodgkin s disease and other tumours of the recticulo endothelial system.

The spleen may be ruptured by injury (see p 245), and in that event removal will be necessary Surgical removal may also be indicated if the spleen becomes chronically enlarged by various medical diseases such as malaria.

CHAPTER 33

THE URINARY SYSTEM

INJURIES to the renal system are discussed in Chapter 27 Many diseases involve more than one part of the renal system, which will therefore be dealt with as a whole rather than in its separate parts

ACUTE INFECTION

Any part of the system may be involved by infection with pyogenic and other organisms. A blood borne infection may develop, especially in the kidneys, but infection is very much more likely to develop if there is obstruction to the passage of urine from any cause infection may then either arrive through the blood stream or more commonly, it may spread up the urinary passages from below

Carbuncle of the kidney

This is the name given to an acute blood borne infection of the kidney

An abscess develops in the substance of the kidney and soon destroys the surrounding kidney tissue. There are pain and tenderness in the region of the kidney and general signs of toxaemia, with a raised temperature and an increase of the pulse-rate. If the infection reaches the pelvis of the kidney there will also be pus cells and bacteria in the urine, but this does not always occur in a carbuncle.

The infection may be assisted to resolve by giving sulphonamide drugs and penicillin, but an operation may be necessary to incise the kidney and drain the abscess.

If the case is neglected, the abscess will probably burst through the outer capsule of the kidney and give rise to a perinephric abscess. This appears as a tender swelling below the ribs posteriorly The general signs of toxaemia continue until the abscess is opened and drained.

Pyelitis

Acute infection of the pelvis of the kidney is usually treated medically Severe infection may also involve the kidney giving rise to pyelonephritis Pyelonephritis is sometimes a sequel to urinary obstruction, and this complication may be the cause of death.

The ureter

The ureter is so rarely infected that there is no special name for infection here!

Acute cystitis

Acute infection of the bladder is again usually treated medically unless it is associated with obstruction

Acute urethritis

The most common cause of acute urethritis is gonorrhoea. An acute infection is treated by sulphonamide drugs or penicillin and if the treatment is given early enough the patient should recover fully

CHRONIC INFECTION

Chronic infection may be the result of persistent acute' infection or it may be due to tuberculosis or to bilharziasis

Persistent acute infection

This most commonly occurs when there is some obstruction to the passage of urine, although a chronic pyelitis may develop without any sign of obstruction These cases are often due to a mixed infection by coliform and other bacilli, and can frequently be cured by combined treatment with sulphonamides and penicillin, the former acting on the coliform bacilli and the penicillin on the other organisms If infection persists the organism is probably resistant to both the sulphonamides and penicillin in this case some other antibiotic must be chosen This choice may be made after the urine has been cultured and the pathologist has reported on the sensitivity of the organism.

If there is any obstruction to the passage of urine this will have to be treated first

Tuberculosis

The renal system is one of the common sites in which tuberculous foci may develop in the late stages of the disease. The infection usually starts in the kidneys and then may spread down the ureters to the bladder From the bladder the infection may enter the upper urethra and the prostate in the male and, from there, spread down the vas deferens to the epididymis which lies behind the testicle. Tuberculous epididymitis may also be due to blood borne infection.

It must be remembered that tuberculosis is a general disease of the whole body and once renal tuberculosis has been discovered, the rest of the body must be examined in order to exclude disease elsewhere. At this stage the most likely foci elsewhere will be in the lungs or bones or joints It will be remembered that the bones and joints most commonly affected are those of the spine, the hip and the knee.

Pathology and diagnosis The first focus in the kidney may be a very small one. It usually lies close to the pelvis of the kidney and tubercle bacilli are secreted in the urine.

The patient may show very few signs referring to the urinary system. He may have a constant aching pain in the region of the kidney and recurrent secondary infection may give rise to attacks of pyelitis. There will be some general toxaemia, but that may be all.

It will be seen that at this stage the signs and symptoms are very vague. If tuberculosis is discovered elsewhere in the body in a case of recurrent pyelitis one's suspicions will be increased but the diagnosis may not be definitely made until the patient is admitted to hospital for investigation.

The urine should be sent to the laboratory for culture and when tuberculosis is suspected, the specimen should be the first one passed in the morning The specimen should be collected and sent to the laboratory on three successive mornings. The tubercle bacillus is very hard to culture, and the result may be negative even though tuberculosis is present. In this case it may be necessary to inject a guinea-pig with the centrifuged deposit of urine, and to wait for a further three months for the pathological examination of the guinea pig The Mantoux

test should also be carried out and the patient's temperature and E S R. level watched.

An X ray can also be taken after the intravenous injection of a dye which is excreted by the kidney (an intravenous pyelogram) This will demonstrate the function of the kidney and may show some abnormality to be present in the shape of the pelvis, no abnormality may be seen, however in the early stages.

Finally, a cystoscope may be passed into the bladder and very narrow, long catheters passed up the ureters (ureteric catheterization) These will drain the urine from each kidney pelvis, and this urine can be collected separately and sent to the laboratory Dye can also be injected up the catheters and an X ray taken (a retrograde pyelogram) This shows up the surface of the pelvis more clearly than an intravenous pyelogram does.

As the disease progresses it slowly destroys the kidney First of all, the inner surface of the kidney becomes ulcerated involving the mucous membrane of the pelvis, then tuberculous abscesses develop in the interior of the kidney, finally the kidney may be totally destroyed and a large tuberculous abscess may develop in the loin

Meanwhile bacilli have been travelling down to the bladder in the urine. They stay there for several hours between the acts of micturition and some of them may penetrate the mucous membrane A *tuberculous cystitis* then develops

This is the stage at which the patient is most commonly seen He has frequency of micturition, and some burning and pain when he passes urine. The urine is usually acid. As the disease progresses the frequency becomes greater until the patient has a constant desire to pass urine and his bladder becomes very small and contracted

In the early stages, before a correct diagnosis has been made, various drugs may be tried in order to cure the cystitis but if they fail to do so tuberculosis should be suspected. Once this possibility has been considered the patient should be admitted for investigation as described above. It may not be possible, however to carry out a cystoscopy and retrograde pyelography, because the bladder is so severely infected that it has shrunk to a small size and cannot be stretched sufficiently for a proper examination to be made.

Infections of the vas and epididymis, via the prostate are described in the next chapter

Treatment We must remember once again that tuberculosis is a general disease and that general treatment is just as important as local treatment. Disease will be sought in the lungs and in the bones and joints and if it is present, will require treatment also

In early cases, when there is only slight cystitis and no evidence is seen of serious renal disease, general treatment together with a combination of drugs may result in a cure. It is best to use two drugs simultaneously in order to prevent drug-resistance from developing the choice will lie between streptomycin, para aminosalicylic acid (P.A.S) and isonicotinic acid hydrazide (isoniazid)

Once the kidney has been badly damaged, the only treatment available is an operation for removal of the kidney (nephrectomy) Fortunately it is usual for only one kidney to be seriously affected and even more fortunately the cystitis frequently disappears once the infected kidney has been removed

If it has been decided to remove the kidney the patient must have careful general treatment for tuberculosis before the operation to bring his health up to the highest possible level, and the general treatment must be continued for several months after the operation has been carried out.

Bilharziasis

Acute or chronic infection by *Bilharzia haematobia* is treated medically

Two complications may however require surgical intervention. These are obstruction of the lower end of the ureters by scar tissue, and carcinoma of the bladder following prolonged chronic infection. Both these conditions are described in later sections, under obstruction and tumours

TUMOURS

Simple tumours

Apart from enlargement of the prostate, the commonest variety of simple tumour is a papilloma of the bladder This starts as a small growth in the mucous membrane it grows out into the bladder cavity forming many small branches which float freely in the urine. Papillomata may also occur in the ureter and in the pelvis of the kidney but these are rare.

The tumour gives rise to no pain, but the delicate surface is easily damaged, so that bleeding occurs and the patient develops a painless haematuria.

The urine will naturally be examined for bilharzia ova, but if this examination is negative the bladder should be examined with a cystoscope.

Small papillomata may be destroyed by burning them with a diathermy needle, which can be passed into the bladder through the cystoscope. A papilloma readily recurs if it is not totally destroyed and after some time it may become malignant and invade the wall of the bladder

If the cystoscope shows that blood is coming down one ureter and is not arising from within the bladder the patient will require specialist investigation and treatment. A papilloma of the pelvis of the kidney is very rare and is usually treated by nephrectomy

Malignant tumours

Kidney

Two varieties of malignant tumour occur in the kidney

The first is a sarcoma, or Wilm s tumour This is not uncommon the author has seen about one case in every three years in Africa.

The tumour commonly affects young children. At first it gives rise to no symptoms, but the parents may eventually discover a tumour in the flank when they are washing the child. By this time the tumour has silently grown to quite a large size. There is usually no pain or haematuria. The condition is extremely malignant and results are very poor, whether the case is treated by operation or by deep X rays.

Secondary tumours from a Wilm s tumour appear fairly early elsewhere in the body They are blood borne, as is the case with most sarcomata, and they frequently appear in the bones of the face. The last case seen by the author was sent in with the preliminary diagnosis of a tumour of the forehead As the child entered the room it was noticed that there was one swelling in the forehead a second swelling in the right cheek and a third on the left side of the lower jaw When examination of the abdomen was attempted, it was found that a tumour of the left kidney had grown so big that it was almost impossible to remove the

child's trousers. This tumour had not been noticed at all by the child's parents. The child was only six years old, but the prognosis was hopeless and no treatment could be offered.

The other variety of kidney tumour is a carcinoma. Like most carcinomata it usually occurs after middle age. The diagnosis *is again not usually made until late in the disease.* There may be slight pain in the loin and, later, haematuria develops and a tumour may be discovered. The renal vein is frequently invaded, and secondaries may occur in the lungs or in bones.

Treatment is by nephrectomy, if the tumour is discovered before secondaries have occurred.

The bladder

Carcinoma of the bladder may arise without any obvious cause. It may follow a recurrent papilloma or it may be the late result of chronic bilharzial infection.

The tumour commences in the mucous membrane of the bladder where it ulcerates and causes haematuria. The surface frequently becomes infected, so that the patient develops the dysuria and frequency of a cystitis.

Later the disease penetrates through the muscular wall of the bladder then either on to the peritoneal surface or into the surrounding pelvic tissue. By this time the lymphatics have usually been invaded, and glands become enlarged along the line of the ureter and beside the aorta.

Diagnosis and treatment Any case of cystitis or haematuria that does not respond readily to treatment should have the interior of the bladder examined with a cystoscope. Only in this way can a tumour be diagnosed at a stage when it can be treated by removal of a part or the whole of the bladder

Too often the patient is first seen when a large firm tumour can be felt above the symphysis pubis. These cases are usually too far advanced for excision and all that can be done is to relieve the dysuria by transplanting both ureters into the bowel. Urine will then collect in the pelvic colon and rectum, and the patient will be able to control it and have some comfort for the last few months of his life.

Prostate

Carcinoma of the prostate occurs in elderly men and is one of the causes of urinary obstruction (see below)

for example where it crosses into the pelvis from the abdomen, or just before it enters the bladder

The symptoms are the same as those of renal stones colic plus haematuria, but the pain is most severe over the part of the ureter which is actually obstructed.

The treatment is again conservative at first in the hope that the stone will pass on. Pain will probably cease within a day or two of commencing treatment and in this case, the stone may safely be left for five to six months in the hope that it will pass on

The stone will have to be removed by operation if it is still present at the end of this period, or it will have to be removed earlier if it is causing persistent symptoms from obstruction of urine

Calculi in the bladder

As previously stated, a vesical calculus may arrive from the ureter or it may start its development in the bladder following chronic cystitis

As long as there is a stone in the bladder cystitis is likely to persist the urine is usually alkaline in any cystitis which is not tuberculous. In the presence of an alkaline urine, phosphates will be deposited on the surface of the stone the stone will gradually grow larger until it may almost fill the bladder

Sometimes a stone becomes arrested just inside the internal sphincter of the urethra, and grows there. The part inside the urethra grows slowly but the part that projects through the internal meatus into the bladder grows more freely and the stone takes on a most peculiar shape.

Signs and symptoms If the stone is lying free in the bladder and cystitis has not yet developed the only symptoms will be those caused by the stone. The stone is free to move about when the bladder contains any urine and when it strikes the sensitive trigone at the bottom of the bladder the patient will have a desire to micturate. As he micturates the stream may be suddenly cut off because the stone has covered the meatus

If urination is not interrupted the bladder will contract down on the stone and, as micturition ends the patient will feel a sudden stab of pain and may pass a few drops of blood. Terminal pain and haematuria are common symptoms of a bladder stone. Pain from irritation of the trigone is usually referred to the tip of the penis, at the external meatus.

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tional symptoms of constant discomfort in the region of th
bladder, with an increase of pain and frequency Dribbling in
continence may occur if the stone is impacted in the interna
meatus holding open the mouth of the bladder

Treatment The condition may be diagnosed from the history
the presence of a stone will be confirmed by a straight X ra
examination

When a stone is present, it is usually removed by a supra
pubic cystotomy

Calculi in the urethra

Occasionally a stone may be held up in the urethra, sometime
at the internal meatus but usually in the perineal portion o
close to the external meatus.

The patient has pain on micturition, which is referred to th
area affected, and the stone can be felt through the skin b
the finger Obstruction of urine does not usually occur, as th
urethra is able to dilate and allow urine to pass round the ston
but the stone may gradually grow bigger as phosphates a
deposited on it.

It may be possible to remove small stones by dilating th
urethra with urethral bougies (sounds) and removing the ston
with forceps, but, in the majority of cases, the urethra will hav
to be incised over the stone (urethrotomy)

OBSTRUCTION OF URINE

The flow of urine from the kidneys may be interrupted at mar
points in its course. The obstruction may be partial and chron
or it may be complete complete obstruction may develop su
denly without previous chronic obstruction or it may develo
as a complication of chronic obstruction.

The common sites and causes of obstruction are as follows

(1) At the junction of the renal pelvis and the ureter
 (*a*) by calculi
 (*b*) by the pressure of an abnormal renal artery
 (*c*) by unknown causes.
(2) In the course of the ureter

for example where it crosses into the pelvis from the abdomen, or just before it enters the bladder

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the urine dribbles past the obstruction without the bladder being able to empty (retention with overflow) or else the pressure rises up the ureters to the pelvis of the kidney and eventually suppresses all secretion of urine. If the condition is not relieved at this stage the patient will die of anuria and uraemia.

When the obstruction is incomplete and chronic the bladder may be unable to empty itself completely at each act of micturition, and some urine will be found in the bladder after the patient thinks he has emptied it completely The urine that remains in the bladder after micturition is known as residual urine, it may be measured by passing a catheter after the patient has urinated.

Later the bladder becomes slowly stretched and it may finally lose its tone altogether

Meanwhile the back pressure has been having its effects on the upper urinary tract. The ureter is a strong muscular tube, and it does not dilate in the early stages but the renal pelvis is less strong and it will begin to dilate with very little back pressure. A dilated renal pelvis is known as a hydronephrosis

After the hydronephrosis has begun to develop the ureter will begin to dilate also forming a hydro-ureter

Finally, continued back pressure will affect the kidney itself Its function will be slowly suppressed until eventually it becomes a thin useless organ stretched over a large hydronephrosis The patient develops uraemia, and the amount of kidney damage will be shown by the level of the blood-urea.

At any stage the stagnant urine may become infected, giving rise to a chronic cystitis or a pyelonephritis.

In obstruction of the ureter or the pelvis of the kidney the effects of hydronephrosis will be confined to one side, and the patient may have very few symptoms

Diagnosis and treatment of the various causes of obstruction

Obstruction at the pelvi ureteric junction

When the obstruction has been caused by a calculus, there will frequently be a history of ureteric colic and of haematuria. The stone may however have grown silently or the obstruction may be due to an abnormal artery or some other unknown cause.

The dilatation of the urinary tract will be confined to the pelvis of the kidney and will form a hydronephrosis Acute total

(a) by calculi
(b) by scar tissue narrowing the ureter after removal of a stone
(c) by scar tissue narrowing the lower end of the ureter after schistosomiasis.

(3) At the bladder mouth by calculi.

(4) Just below the bladder mouth
(a) by rare congenital valves
(b) by benign prostatic enlargement
(c) by carcinoma of the prostate.

(5) In the urethra, by strictures following gonorrhoeal infection.

(6) At the meatus by a phimosis of the foreskin.

The first two groups may affect either sex as they occur above the bladder, obstruction is not likely to be fatal, even when it is total because the condition is usually confined to only one kidney or ureter The next four sites involve the urinary flow from both kidneys They are practically confined to the male sex, as bladder calculi are rare in the female owing to the short course of the urethra and its capacity for wide dilatation the same reason accounts for the rarity of stricture of the urethra and, of course, there is neither a prostate to give rise to trouble below the bladder mouth, nor a foreskin to cause phimosis.

A rare cause of acute obstruction of the urethra, in women is the presence of a large tumour of the uterus, impacted in the pelvic cavity Obstruction may also be caused if the pregnant uterus becomes impacted in the pelvis or if the foetal head becomes impacted there during an obstructed labour

Effects of urinary obstruction

The effects of obstruction will naturally depend upon the level of the obstruction.

Obstruction below the bladder will at first be met by hypertrophy of the bladder which will try to squeeze urine out at each act of micturition. If obstruction becomes suddenly complete, the bladder is unable to empty and the patient has severe pain and distension of the organ which rapidly rises to the level of the umbilicus. This is known as acute retention of urine.

If the acute retention is not relieved, one of two things may happen. Either the pressure in the bladder rises so high that

fills again sooner than usual The increased frequency is most marked at night and the patient finds that he has to get out of bed to pass urine two or three times during the night.

The patient may also find some difficulty in starting the act of micturition and that he has to be totally relaxed before the urine begins to flow if he strains the flow stops This is in contrast to an obstruction by a stricture of the urethra in which increased force will drive the urine past the obstruction There may be trouble too at the end of micturition, for the patient finds that a few drops flow out after he thinks that he has finished.

Any man who gives such a history, especially if he is over fifty, should have a rectal examination to judge the size of the prostate. The prostate can be felt quite easily through the anterior wall of the rectum.

We have already seen that continued obstruction results in back pressure on the kidney The patient becomes tired and listless and may suffer from headaches. The kidneys also lose their power to concentrate urine, and this will increase the nocturnal frequency further The estimation of the blood urea will show the degree of uraemia that has developed

An enlarged prostate may be complicated at any time, by acute retention of urine. This is usually caused by congestion of the gland, which causes a sudden increase in the size of the swelling

Acute retention, occurring in the early stages, is accompanied by severe pain and demands instant relief Retention in the later stages occurs in an already stretched and dilated bladder, there is little pain, but, as the pressure rises, there will be an overflow incontinence. Incontinence in an elderly patient is frequently due to obstruction and not to paralysis of the sphincter

Treatment The proper treatment for prostatic obstruction is to remove the benign tumour of the gland by operation. The timing of the removal is however most important.

(1) *Acute retention in the early stages with no rise in the blood urea or other sign of kidney damage* The prostate may be removed as an emergency It is not always possible to obtain an emergency report on the blood urea and so it is more usual to relieve the obstruction first and then remove the prostate after a day or two The obstruction may be relieved either by passing a catheter repeatedly or by passing a catheter and tying it into the urethra or by carrying out a suprapubic cystotomy The chief risk in all

obstruction gives rise to severe pain in the region of the l and, if the obstruction is unrelieved, to complete loss of fu of the organ. The obstruction is more often partial, with pe attacks of more complete obstruction. In these cases the p has attacks of pain in the loin, which subside as the obstru diminishes. The relief of pain may be accompanied by a of urine from the kidney Each attack will result in an inc in the size of the hydronephrosis, which may become so bi a tumour can be felt.

The patient must be examined carefully and a full hi taken, then if disease of the kidney is suspected, a straight X and an intravenous pyelogram will be carried out. The str X-ray will show a calculus if it is present, and the pyelo will show the extent of the hydronephrosis

Surgical treatment will be required. A small hydroneph may be treated by treating the cause but when the hy nephrosis is large, a nephrectomy will be the most satisfac operation. A nephrectomy will not, of course, be carried o the opposite kidney also is affected! The intravenous py gram will demonstrate the function of the opposite kidney, the blood urea can also be estimated in order to see whet there has been any effect on the general health of the patient.

Obstruction in the ureter

Calculi passing down the ureter or becoming arrested there g rise to acute colic and haematuria. If they remain in positi or if the cause is a stricture, the symptoms will be the same as the last group An intravenous pyelogram will show a hydr nephrosis and a hydro-ureter above the level of the obstructio

Mild cases may be treated by removal of the calculus or e cision of the stricture in obstruction at the lower end, the uret may be divided above the stricture and inserted into anoth part of the bladder wall.

Severe cases are treated by nephrectomy as long as the oth kidney is healthy

Benign prostatic enlargement

Enlargement of the prostate rarely occurs before the age of fifty

One of the first signs is an increased frequency of micturition This is largely due to poor emptying of the bladder so that it

mask, he must remove his watch from his wrist, roll up his sleeves and scrub up his hands and forearms for a full five minutes. The hands and forearms should then be dried on a sterile towel so that drips will not fall on the sterile instruments The catheter itself must be sterilized, and so must all dishes and the lubricant which is going to be used. In some hospitals the catheter is not touched by hand at all, but is gripped by artery forceps and passed into the urethra that way

A distended bladder with a congested mucosa is all ready for infection and a cystitis can easily be caused by faulty catheterization

If catheterization fails, sounds may be tried. In many cases the stricture can be overcome and the bladder can then be drained by passing a catheter The catheter may be tied in and drained into a bottle tied to the side of the bed it must not be left draining into a kidney dish.

When even sounds fail a suprapubic cystotomy will be required. Where there are no facilities for carrying this out, the bladder may be relieved by the insertion of a lumbar-puncture needle into the bladder above the symphysis pubis, and this may be left in until the patient reaches hospital.

A suprapubic catheter is drained into a bottle at the side of the bed the patient is given sulphonamides and penicillin to counteract infection, and the bladder should be washed out twice a day with a 1 10 000 solution of flavine in water

After about a week the patient is taken back to the theatre, and it may then be found that oedema has subsided and that sounds can be passed The suprapubic tube can then be removed and the abdominal fistula allowed to close.

In some cases passage of sounds will still be impossible and then an operation will have to be carried out in order to expose the urethra, to excise the stricture and to suture together the divided ends of the urethra. This is known as an external urethrotomy with repair of the urethra.

After the correction of acute obstruction, it will be necessary to keep the passage open by the repeated passage of sounds over a long period.

Chronic obstruction

When obstruction is only partial, it will almost always be possible to pass sounds The urethra should be dilated gently

English or a French gauge and this may give rise to confusion. In the following sections the gauge referred to will be the English one.

The sounds are so constructed that the shaft is three sizes bigger than the tip This means that if the tip passes the stricture and then the shaft is passed through, the stricture will be dilated up by *three numbers*. The numbers are shown on the handle of the sound, for example 3/6 or 7/10

The small gauges are very fine and sharp and there is a grave danger that they may penetrate through the mucous membrane of the urethra instead of passing through the small hole formed by the stricture. This is known as making a false passage' A false passage can also be made by the larger sounds if they are forced into the urethra. Force should never be used, and if a sound cannot be passed, the obstruction must be relieved by other means. It is not wise to use any sound smaller than 5/8

Another danger in the passage of sounds is that of stretching the stricture too far This will tear its walls, and the tear will heal by scar tissue, leading to a recurrence of the stricture. If *a sound passes tightly through a stricture, only two more sizes* should be used. For example, if 5/8 just passes then the stricture should not be dilated above 7/10 In this way the stricture will be stretched from size 5 to size 10 this is enough for one session Larger sizes can be used on subsequent occasions

Treatment of acute retention, caused by a stricture

When a patient is admitted with acute retention of urine the first procedure will be to take his history this may suggest the presence of prostatic obstruction or of a stricture.

Next, the *prostate* should be examined by rectal palpation.

The retention of urine must then be relieved. A rubber catheter should be tried and a Tieman s catheter is very useful as it has a firm, narrow tip If the rubber catheter enters the bladder easily then the cause of the obstruction is almost certainly prostatic enlargement.

If the rubber catheter meets a stricture which it cannot pass, then a gum-elastic catheter may be tried. *This may enter the* bladder when a rubber catheter has failed

Catheterization may be carried out in the ward, but this does not mean that the sterility of the operating theatre may be relaxed. The dresser medical assistant or doctor must wear a

possible by the age of three or four and it should be quite easy by the time the boy is thirteen or fourteen

At the age of adolescence the cleft between the foreskin and glans begins to collect secretions called smegma, and from this age onwards the foreskin should be retracted daily so that the secretions can be washed away If this is done properly there will be almost no chance of carcinoma developing in late adult life.

The foreskin acts as a natural protective cover to the sensitive glans and so should not normally be excised by circumcision. The indications for circumcision, apart from tribal or religious custom, are either a very tight phimosis which is definitely obstructing the passage of urine, or deformity of the foreskin following paraphimosis. In order to provide access for treatment of secondarily infected venereal disease, instead of full circumcision the foreskin is sometimes split down the back (dorsal slit)

Circumcision for tribal purposes is part of a ceremony in which the individual is initiated into the full life of the tribe, and it is usually accompanied by instruction in the duties and responsibilities of adult life. The time and money of hospitals should not be spent on providing circumcisions at the request of individuals who have no intention of passing through a full initiation ceremony Hospital circumcisions should only be carried out for strictly medical indications.

Paraphimosis

This is a complication of a relatively tight foreskin and it is most commonly found at or before adolescence when the orifice of the foreskin has not yet fully dilated.

The boy has retracted his foreskin, using a little extra force to get it right back past the glans the glans then swells and he finds that he cannot replace the foreskin. If the paraphimosis is not soon corrected, the tension and pressure lead to sloughing and gangrene of the tight rim of foreskin round the dorsum of the penis

Reduction is usually possible in the first day or two after a paraphimosis has developed, if a little time and care is taken. The important step is to spend up to five minutes compressing the swollen glans with the fingers and thumb of one hand, thus

driving blood and oedema fluid back through the stricture. Both thumbs may then be placed on the glans and the fingers beyond the paraphimosis and, with a little pressure the foreskin can be drawn back into place. If this fails success may follow reduction of oedema by the injection of 500–1 000 units of hyaluronidase into the swelling

In later cases, when ulceration has already occurred, the ulcer should be dressed with 20 per cent. saline daily and sedatives given to relieve pain. When healing has occurred the deformed foreskin may be circumcised

HAEMATURIA

Haematuria is a symptom of many diseases It is such a common urinary complaint that some thought must be given to its possible cause in every case, so that the proper treatment can be given

The most common cause in the tropics apart from injury to the kidneys or urethra, is bilharzial infection the presence of bilharzial ova in the urine will confirm this diagnosis

In some cases however, no ova may be found or the symptom persists despite a full course of medical treatment. These cases will require further investigation which may take the form of cystoscopy in order to examine the interior of the bladder intravenous pyelography to examine the function of the kidney or retrograde catheterization and pyelography in order to collect the contents of the pelvis of the kidney and to see the outline of the pelvis on an X ray film.

The possible causes that must be considered, and looked for, are

Injury to the kidney bladder or urethra,
Acute or chronic *cystitis*,
Urinary *calculi*
Papillomata of the bladder or rarely of the pelvis of the kidney and
Carcinoma of the bladder or kidney

CHAPTER 34

THE SCROTUM

DISEASES of the scrotum may arise in the skin the cavity of the tunica vaginalis, the testicle, the epididymis or the cord

THE SKIN

Elephantiasis

Elephantiasis of the scrotum is due to filarial damage to the lymphatics. In the early stages the patient experiences attacks of filarial fever The skin of the scrotum during the attacks becomes a little thickened and inflamed, and the patient suffers from a mild general toxaemia. The attacks may be treated by giving the patient Hetrazan (diethylcarbamazine) tablets (ten a day for seven days) these will reduce the number of microfilariae, but will not restore the scrotum to its normal size if skin changes have taken place.

With each attack the scrotum becomes more and more thickened, and an accumulation of fluid appears in the subcutaneous tissue, and often in the sac, or inner cavity of the tunica. In some cases the skin will suddenly release fluid, which leaks out freely from all over the surface.

When permanent changes have occurred in the scrotal skin the only treatment available is surgical excision of the scrotum.

Phagedaena

Thrombosis of the vessels sometimes occurs in a large scrotum whether the enlargement is due to filariasis hernia or hydrocele, or a combination of these causes The thrombosed skin becomes gangrenous and is frequently infected with organisms similar to those of tropical ulceration and cancrum oris The fungating ulcer discharges freely and smells badly

The discharge and smell can be reduced quite considerably by excising as much as possible of the dead tissue. This can be done in the ward without an anaesthetic, as the tissue is dead and insensitive.

Frequent dressings and treatment with penicillin will soon convert the condition to a clean ulcer The large ulcerated area may then be treated by skin grafting or allowed to heal by scar tissue formation. The scar tissue contracts as it heals and quite a large ulcer may shrink to a comparatively small scar

Scrotal sinuses

Scrotal sinuses are an indication of underlying disease. Single or multiple sinuses that discharge urine will have arisen from a stricture of the urethra with the formation of a peri urethral abscess (Chapter 33) A sinus that leads to the testicle usually arises from tuberculosis of the epididymis

THE TUNICA

The tunica vaginalis of the testicle arises from the portion of the peritoneum which came down with the testicle in its descent. When a congenital hernia is present, the tunica may become distended with peritoneal fluid, omentum or some other abdominal organ.

Hydrocele

Even when no hernia is present, the tunica may become distended with fluid. This swelling is called a hydrocele. The tunica constantly secretes a small quantity of lymph like fluid and this permits free movement of the testicle within the cavity This secretion is similar to the secretion from the peritoneum in the abdomen and it should normally be absorbed by the lymphatics.

Ascites is most commonly due to obstruction of normal drainage from the peritoneal cavity and this also is the most common cause of a hydrocele. The obstruction in this case is frequently filariasis of the inguinal lymphatics but some cases of hydrocele have no obvious cause.

A hydrocele may be treated by aspiration but is likely to recur The chance of recurrence may be reduced by injecting sclerosing solutions into the sac, such as are sometimes used for the treatment of varicose veins, but these will not give a certain cure and may give rise to considerable pain. The only certain cure for a hydrocele is an operation in which the sac is opened and turned inside out.

Haematocele

A haematocele is a collection of blood in the sac. It is almost always the result of an injury, the injury may be a kick or other blow on the scrotum or it may be the result of an attempt to aspirate a hydrocele, the needle having punctured the testicle or a vein. It may also follow reactionary haemorrhage after operations on the scrotum

A haematocele which follows a blow may be treated by aspiration of the blood. If the condition follows attempted aspiration of a hydrocele there will probably be blood in the surrounding tissues as well In this case it is better to allow the body to absorb as much of the haematoma as possible. The patient may then have the rest of the clot removed by operation. Complete relief from the heavy swelling may require an orchidectomy (excision of the testicle)

THE TESTICLE

The testicle is subject to very few surgical diseases An enlarged heavy testicle is usually the site of a gumma of tertiary syphilis but one must always remember the possibility of *carcinoma* of the testicle this must be seriously considered if the Kahn test is negative or if the condition does not respond to anti syphilitic treatment.

If carcinoma is suspected, an immediate orchidectomy should be carried out. The lymph drainage from the testicle is to the aortic glands and these should be treated with deep X-rays, if available.

Acute inflammation is either the result of an epididymo-orchitis from gonorrhoea or an acute orchitis caused by the virus of mumps

Undescended testicle

The normal descent of the testicle is described in Chapter 29 Both the testicles should be in the scrotum by the time a child is born but sometimes the descent is delayed this occurs more frequently on the right side than on the left.

An undescended testicle may descend after birth and for the first twelve years of life, non-descent is unimportant. If however the testicle has not descended shortly before puberty

treatment will definitely be required. A testicle which does not descend before puberty will atrophy and be unable to produce *spermatozoa* it is also more likely to develop cancer than is a descended testicle.

An undescended testicle is frequently accompanied by a congenital hernia.

Diagnosis The testicle may be drawn up towards the inguinal canal by the cremaster muscle and, during examination, one must make sure that this has not happened. If the scrotum of an infant, or young boy, is empty, on one or both sides, the testicle should be felt for in the inguinal region, and an attempt made to draw it down into the scrotum if it is found. If it can be drawn down easily, it was probably drawn up temporarily by the cremaster, *if it can be felt, but cannot be drawn down easily, it will* almost certainly descend by itself at puberty

Treatment The descent of the testicle is stimulated by hormones, from the mother before birth and from the child s own testicles at puberty These hormones can be given by injection in cases of non-descent, but they should not be given before the age of ten because they will stimulate too early growth of the penis and the development of other adult sex characters

After the age of ten a short course (six to ten weeks) of hormone therapy may be tried but if this fails and the testicles are still undescended, then at the age of twelve, they should be brought down into the scrotum by operation and fixed there.

Operation may be indicated earlier if an obvious hernia is present. The testicle should then be brought down and fixed in the scrotum at the same time as the hernia is repaired.

THE EPIDIDYMIS

As with the testicle acute infection is usually due to gonorrhoea.

Chronic infection is almost always tuberculous The infection usually spreads down the vas deferens from the prostate, and the condition is commonly *secondary to tuberculosis of the kidney* It may however arise as a direct blood borne infection When a tuberculous epididymitis *has been diagnosed the lungs, bones* and joints should be carefully examined in order to exclude foci of the disease

Tuberculous infection of the epididymis results in a hard swelling of the organ and this thickening *can be felt lying*

behind the testicle. When the cord is palpated the vas deferens will also be found to be thickened If the disease is neglected a cold abscess may develop, and this will track towards the surface of the scrotum and form a sinus there.

Treatment Tuberculous epididymitis is treated by an excision of the epididymis and of the vas as far as the groin. It is not usually necessary to do an orchidectomy One must always remember that tuberculosis is a general disease as well as the local excision, general treatment and treatment of other foci of infection will be required

THE SPERMATIC CORD

The cord can be examined readily between the finger and thumb Any thickening of the vas will then be discovered. A soft thickening of the cord is usually due to varicose veins leading from the testicle. These require no treatment. A nodular thickening of the vas is usually tuberculous and is associated with a thickened epididymis.

In some cases it may not be possible to palpate the cord because of the presence of a hernia or a large hydrocele.

A hernia may not descend as far as the scrotum, and it will then only involve the upper part of the cord It will be found, on examination that the swelling reaches right up to the inguinal ring and that it is impossible to get one s fingers above the swelling Further proof that the cause of the swelling is a hernia will of course, be obtained if it is possible to reduce the swelling into the abdomen.

A large hydrocele may be so big that it fills the whole scrotum and rises up as far as the inguinal ring In these cases the hydrocele may be so tense that one cannot feel any cord above the swelling and an irreducible hernia may be suspected. One must then go carefully into the history and find out whether the swelling has ever been reducible the swelling must also be examined carefully A large hydrocele will be tense and [illegible] and it will feel as if it contains a large quantity of fluid [illegible] hernia will only be equally tense if it is strangulated [illegible] will then be in severe pain and may have vomited, [illegible] it possible to come to a proper diagnosis Treatment [illegible] then be carried out accordingly

CHAPTER 35

GYNAECOLOGY

GYNAECOLOGY is the study of the *diseases of the female* genital system. As medical assistants are not expected to have a detailed knowledge of these diseases and their treatment, only an outline will be given of the more common conditions that may be present.

The genital system in women has a double function The first is to produce ova from the ovary and this is done regularly once a *month in a normal woman of child bearing age*. The *second* is the protection and nourishment of the foetus for the nine months of pregnancy if the woman conceives

Some diseases are *quite unconnected with pregnancy although* they may be present at the same time as pregnancy, others are entirely the result of abnormalities of pregnancy or of labour Therefore one of the most important steps in taking the history of and examining any woman of child bearing age is to try to find out whether pregnancy has occurred or not.

General diseases will be discussed first.

ACUTE INFECTION

Acute infection is usually gonorrhoeal although this is not always the case. Infection enters by the vagina and passes through the cervix and uterus until it reaches the Fallopian tubes. Acute infection rarely occurs actually in the walls of the uterus unless it is secondary to the presence of a malignant tumour or follows a pregnancy

Infection of the tubes however is not uncommon It is known as *acute salpingitis* The signs and symptoms are very similar to acute appendicitis with the exception that the pain is low down in the abdomen, on one or other or both sides of the mid line just above the symphysis pubis

Tenderness is found in this area and the patient has the signs and symptoms of a general toxaemia, with a rise of temperature and an increased pulse-rate. Treatment in the early stages with

sulphonamides or penicillin [illegible] of the infection, but scar tissue [illegible] tube and sterility may result.

If the infection is neglected, it [illegible] pelvis, and the temperature will [illegible] drained either by an abdominal [illegible] the upper end of the vagina. The [illegible] indicated if the infection has given [illegible] tonitis. General peritonitis is very [illegible]

CHRONIC [illegible]

This may be either a persistent pyogenic [illegible] tuberculosis.

In persistent pyogenic infection there [illegible] tube and surrounding tissues, which usually [illegible] of the affected side. The centre of the mass usually [illegible] abscess cavity. In any case that resists sulphonamide or penicillin treatment it is usually necessary to [illegible] ovary of that side (salpingo-oöphorectomy).

Tuberculosis results in a chronic low-grade infection. [illegible] may be very little pain or other symptoms of local disease [illegible] there will be the usual general ill health associated with tuberculosis and there may be obvious signs of the disease elsewhere. The infection attacks both the tubes and the inner lining of the uterus.

It is not known how common the disease is amongst Africans but in some parts of Europe it is one of the most common causes of sterility. The condition is most frequently diagnosed by examining the result of scraping or curetting the inside of the uterus, when curettage has been done in order to investigate sterility. This operation is performed with an instrument called a uterine curette.

TUMOURS

Benign tumours

Benign tumours commonly occur in the uterus and in the ovary. The tumour of the uterus consists of a firm lump of fibrous and muscular tissue which is usually known as fibroid. Fibroids are frequently multiple in any patient who develops them, and and they can grow to a very large size if they are neglected.

Fibroid uteri can be found, even in these days which reach almost up to the xiphisternum.

They are typically hard irregular tumours which distort the normal shape of the uterus. When they are big they can be felt through the abdominal wall but in the early stages they will be still down in the pelvis and can only be felt by someone who has been trained to do vaginal examinations

They give rise to congestion of the uterus and must be suspected if a patient complains of excessive menstruation Continuous bleeding may lead to severe anaemia.

If the tumours are found early enough they may be removed by incising the uterus over each tumour and removing them separately (myomectomy) but if the fibroids have grown to a large size the whole uterus will require removal (hysterectomy) Prolonged pre-operative treatment may be required for correction of anaemia.

Tumours of the ovary are frequently cystic. They may give rise to no symptoms at all until they reach a very large size. A large ovarian cyst forms a round swelling full of fluid which lies towards the mid line of the abdomen The condition may appear to be very similar to an ascites but in the latter case the *maximum area of dullness is in the flanks instead of in the middle line*

It might be convenient at this stage to mention the four things beginning with the letter F which give rise to marked enlargement of the abdomen they should always be thought of when a patient complains of abdominal distension either chronic or acute. They are

Fat (in the abdominal wall and mesentery)
Fluid (ascites or ovarian cyst)
Flatus (shown by tympanitic distension—intestinal obstruction or paralytic ileus) and last, but not least,
Foetus (in the uterus in a normal pregnancy)

Malignant tumours

The cervix of the uterus is the commonest site for malignant disease in women. The disease attacks the portion of the cervix facing the vagina, as a rule. It soon ulcerates and *gives rise to* irregular vaginal bleeding As with all types of malignant disease the results of treatment are good if the case can be

treated early, either by the use of radium or by a total hysterectomy, including the cervix and all surrounding tissue.

Early diagnosis is therefore very important and any woman who complains of bleeding between the normal periods, or any woman who has ceased to menstruate and then has a recurrence of irregular bleeding should be sent at once to hospital for examination The condition is uncommon under the age of forty

Malignant tumours of the ovary are much more difficult to diagnose and, fortunately they are less common. The woman may complain of general ill health, loss of weight and perhaps some irregularity of menstruation, and the tumour may then be discovered during the routine examination of the patient.

Treatment is by excision of the tumour if it is discovered early enough.

CONGENITAL ABNORMALITIES

Various congenital abnormalities may occur in the genital system, such as a double uterus or vagina, but the only one of real importance is an *imperforate vagina*. This will not be noticed until the girl begins to menstruate, and may not be noticed until she has actually menstruated for some time.

The blood of menstruation is unable to escape and the patient may be brought to hospital because she is well past the normal age for the onset and no blood has been seen. If she has had many menstruations the blood will have accumulated in the vagina, and possibly in the uterus, and the tissue closing the vagina may be seen to be thin and bulging outwards. It is a simple matter to incise the tissue and allow perhaps one or two pints of retained old blood to escape.

ENDOCRINE DISORDERS

We have already mentioned the normal monthly menstruation of a woman during the child-bearing period. This lasts from the onset of menstruation, about the age of twelve or thirteen, until the age of forty to forty five. Some girls begin to menstruate earlier or later than the normal age, and some women cease menstruation either early or late.

The normal menstrual history which should be inquired into

in any female of child-bearing age with pelvic complaints, is for the person to lose menstrual blood for four to five days, commencing twenty eight days after the beginning of the previous menstruation.

This may be recorded as Menstruation 4–5/28

Menstruation has no purpose in itself It is a sign that pregnancy has failed to occur

What happens every month during a normal woman's life is as follows menstruation leads to a loss of thickness of the inner lining of the uterus this is accompanied by bleeding During the following two to three days the uterine lining re-grows, then about ten days after menstruation ceases, one of the ovaries produces an ovum.

This ovum finds its way into the open end of a Fallopian tube, and there it may meet a spermatozoon and become fertilized—if it does conception has occurred and the fertilized ovum will move down the tube to the uterus

From the moment that the ovum has been produced by the ovary the ovarian hormones begin to have their effect on the inner lining of the uterus, which thickens further and becomes very vascular in preparation for the nourishment of the child More often than not, however the ovum fails to meet a spermatozoon. The inner lining of the uterus still thickens in the hope that fertilization may have occurred, but, when it finds that it has not happened it throws off the thickened tissue with the blood of menstruation The cycle then begins all over again.

Amenorrhoea

This is the cessation of menstruation altogether The most common cause is pregnancy The fertilized ovum has reached the thickened inner wall of the uterus and the hormones, first from the ovary and later from the placenta itself keep the inner wall intact and menstruation fails to occur

Amenorrhoea may also occur in severe debilitating illnesses such as tuberculosis or thyrotoxicosis

Oligomenorrhoea

This means scanty menstruation. It is not of serious importance but may indicate that the patient is suffering from tuberculosis or other disease.

Menorrhagia

Menorrhagia is excessive menstrual loss of blood. The menstrual periods may be a normal twenty-eight days apart, but very heavy or bleeding may occur between the normal times of the periods, giving a menstrual history of say, 6/14 (six days bleeding recurring every fortnight)

The commonest cause of menorrhagia is a uterine fibroid, but the cause may be disease of the ovary Any patient with menorrhagia should be referred to a medical practitioner for investigation

Dysmenorrhoea

This is the name given to pain during menstruation. It occurs very frequently in a mild degree but often disappears after the woman has become pregnant and has had the cervix stretched by the delivery of a child. Moderate cases may require treatment with analgesics, such as aspirin during each monthly period more severe ones may be treated by dilation of the cervix with special dilators.

DISEASES ASSOCIATED WITH PREGNANCY

The signs and symptoms of pregnancy are, in brief amenorrhoea of short duration in a woman of child bearing age, a gradually enlarging abdominal tumour the presence of foetal movements and a foetal heart-beat after four and a half to five months, and a feeling of enlargement of the breasts.

The diseases and disorders of pregnancy are best considered in relation to the stage of pregnancy that has been reached—the first to be considered is failure to conceive, that is sterility

STERILITY

Sterility may arise from many causes, and it is by no means always the female partner that is at fault. The male may be responsible because he is unable to produce sufficient active spermatozoa as a result of a hormonal disorder or because his vas deferens has been blocked on each side by tuberculosis or following gonorrhoeal epididymo-orchitis.

The common causes in the female are also hormonal disturbances, gonorrhoeal stricture of the tubes, or tuberculosis

through the wall usually into the peritoneal cavity This commonly results in death of the foetus the inner lining of the uterus, which has been thickened during the pregnancy is then discarded with accompanying bleeding

The bleeding may suggest a threatened abortion, but the condition is very much more serious, and this is the reason why careful examination must be made whenever bleeding starts during pregnancy

The rupture of the tube is usually accompanied by severe haemorrhage into the peritoneal cavity and the patient may be severely shocked, vaginal examination shows the presence of a swelling due to the presence of blood in the pelvic cavity The intraperitoneal bleeding may be severe enough to be fatal.

The treatment is by an emergency abdominal operation for removal of the ectopic pregnancy a salpingo-oōphorectomy is usually performed. A blood transfusion may be required, before and during operation, for the treatment of shock.

Hydatidiform mole

This is a rare cause of bleeding in the first few months of pregnancy Something has gone wrong with the development of the placenta, and it is replaced by a growth of many little capsules filled with fluid. After a few months the body tries to get rid of this mass, and bleeding begins. The bleeding is accompanied by discharge of parts of the tumour mass.

The uterus must be cleared out by careful curettage and the patient must be examined repeatedly afterwards, as this condition is sometimes followed by a special variety of cancer

HAEMORRHAGE IN THE LAST THREE MONTHS OF PREGNANCY

During the last three months of pregnancy there are again two principal causes of bleeding The first arises by the same mechanism as a threatened abortion. It is an accidental haemorrhage which may cease, the pregnancy then continuing its full time, or it may be followed by labour contractions so that a premature infant is born. The only difference between a *premature labour* and an abortion is the fact that, after six months, there is a good chance that the child may survive.

The other main cause of bleeding in the last few months is a

placenta praevia Normally the placenta lies high up on the wall of the uterus but sometimes it may be attached low down, near the cervix. In this case bleeding will be inevitable when the cervix begins to dilate.

As in an ectopic gestation, the haemorrhage may be severe enough to be fatal. One is therefore again advised to refer to a hospital all cases of bleeding during pregnancy so that expert examination may lead to a proper diagnosis and the appropriate treatment. Many cases of placenta praevia will be treated by Caesarian section, in order to save the life of both the mother and the child.

COMPLICATIONS OF LABOUR

This is not the place to discuss either normal or abnormal obstetrics in detail It may be said, however that the great majority of labours proceed without any anxiety

Trouble may arise from an abnormal position of the foetus or from maternal passages which are too small for normal delivery In very occasional cases the umbilical cord may prolapse through the cervix before the child and become compressed between the child's head and the pelvis so that the child dies.

Minor difficulties are sometimes treated by turning the child round to a better position or by the application of obstetric forceps to extract the child. More serious conditions are frequently treated by Caesarian section.

In Caesarian section, the abdomen and then the uterus are opened and the child extracted. Very great care must be taken over the question of anaesthesia for any obstetrical procedure, as the anaesthetic will have an effect on the child as well as on the mother If too deep an anaesthetic is given the child may be so anaesthetized when it is born that it fails to make the effort required to begin breathing Great care must also be taken to avoid vomiting by the mother as the patient has frequently been given tea during the earlier stages of labour if this is vomited there is a risk of aspiration into the chest.

Retained placenta

The placenta may remain within the uterus after the foetus has been delivered either by normal or premature labour The uterus is then unable to contract down properly and bleeding

will continue until the uterus is emptied This is usually done manually, that is by a hand which is passed through the dilated cervix into the uterus The hand then sweeps round and pulls the placenta out, but this treatment is not indicated until the uterus has been given a little time to contract down and expel the placenta itself The condition is essentially the same as that of an incomplete abortion, where the uterus is emptied by careful curettage.

COMPLICATIONS AFTER DELIVERY

Three conditions are of importance—puerperal sepsis, prolapse of the uterus and the formation of fistulae between the vagina and the bladder or the rectum.

Puerperal sepsis

Careless attention to detail during a normal delivery may give rise to sepsis within the uterus. This used to be the major cause of maternal deaths following labour Proper obstetrical care will make the condition rare and when it does occur the majority of patients will recover with penicillin treatment.

Prolapse of the uterus

In Chapter 29 it was pointed out that the lower end of the abdomen is closed by the pelvic diaphragm of muscles, through which pass the rectum, the urethra and, in the female the vagina.

The gap in the diaphragm surrounding the vagina may be badly stretched during labour so that the vagina and uterus herniate downwards.

The front wall of the vagina is closely applied to the bladder and the bladder will tend to prolapse through the diaphragm also. Urinary symptoms are the commonest sign of a mild degree of prolapse. The patient may have some frequency of micturition and dysuria, but more commonly the principal complaint is of slight incontinence caused by sudden abdominal strains such as laughing

In the more severe degrees the vagina turns inside out as it passes down through the vulva, and the uterus may descend right down until the cervix lies outside the vulva.

Treatment is by an operation in which the bladder and uterus

are replaced and the pelvic diaphragm repaired. At the same time the vagina itself is narrowed by the removal of stretched tissue from its walls

Vaginal fistulae

Where there is serious difficulty in the delivery of a child, whether because of the size of the child or the narrowness of the maternal passages several complications may occur

The child is likely to die if delivery is not assisted by Caesarian section or other means the mother herself may die from exhaustion, shock, infection or rupture of the uterus.

In other cases the child is delivered after several hours or days delay The delivery may be unaided or by forceps

All the time that the woman has been in labour in these neglected cases, the child's head has been pressed firmly into the mother's pelvis, and the mother's soft tissues have been squeezed between the child's head and the bony pelvic ring

The pressure gives rise to thrombosis of the blood vessels in the soft tissue, and this is followed by local gangrene. The gangrenous slough may separate soon after delivery, or it may not do so for several days When it does separate, a fistula appears between the vagina and the bladder or between the vagina and the rectum or both. The first is known as a *vesico-vaginal fistula* and the second as a *recto-vaginal fistula.*

Treatment The first step in treatment is to remove all trace of infection and allow the sloughs to separate.

A patient with a vesico-vaginal fistula will be most uncomfortable, with perpetual incontinence of urine, and every attempt must be made to repair the fistula. In recto-vaginal fistulae the condition is not quite so serious, because stools are fully formed by the time they reach the rectum and very little of the faeces may come through the fistula.

Local repair of a fistula is the best method of treatment, if it can be managed successfully Sometimes this is impossible owing to the size of the hole and the thickness of the surrounding scar tissue.

When local repair fails, the ureters may be transplanted into the bowel. This operation has a higher immediate mortality than local repair and there is also quite a high mortality during the years that follow owing to ascending infection which has travelled up the ureters and given rise to a pyelonephritis.

Before transplanting the ureters, the surgeon must make sure that a local repair is impossible, and he must also be satisfied that the rectal sphincter is undamaged and that there is no recto vaginal fistula present. The patient will not be helped if she is unable to retain urine in the rectum, after the ureters have been transplanted into the bowel

PART FIVE

OPERATIVE SURGERY AND WARD PROCEDURE

CHAPTER 36

ADMISSION EXAMINATION AND PRE-OPERATIVE PREPARATION

EMERGENCY SURGERY

MOST surgical emergencies require operative treatment and in many cases the operation should be carried out as soon as the patient is fit for it. (A severe head injury and a fracture of the pelvis are examples of emergencies requiring urgent, but not necessarily operative treatment.)

Included amongst surgical emergencies are all open wounds of less than twelve hours duration, and most varieties of acute abdomen

History examination and pre-operative preparation must all be as thorough as circumstances will allow but speed is important and time must not be wasted by going into unnecessary details

History

A short history must be taken and recorded. It is most important to record the *time of the injury* or onset of the symptoms the *time of admission* to hospital and the *time of examination.*

Examination

The examination consists of two parts. The first is an examination in order to make a provisional diagnosis and the second is a general examination for assessing the fitness of the patient for operation. Injuries to other parts of the body must not be overlooked, either when taking the history or when examining the patient.

The diagnostic examination must be as thorough as possible, but one must be very careful not to aggravate the condition by unnecessary investigations It is usually unnecessary for example, to remove the first aid dressings from a recent wound unless bleeding is still occurring Even then, bleeding may be controlled by simple elevation. Nerve and tendon function can be tested in most cases without removing the dressing and the wound should be left undisturbed until the patient is anaesthetized

Even more important is the realization that, if shock is already present, detailed examination must be delayed until shock has been overcome.

A severely injured patient must be made warm and comfortable, but not overheated, his blood pressure must be recorded and anti shock treatment started at once. His clothes should not be removed unless they are soaking wet, nor should any attempt be made to clean him up until he has a blood pressure of over 100 systolic, and, even then, extreme gentleness must be used in handling the patient.

A surgeon should be informed as soon as a seriously ill patient has been admitted, and at the same time the theatre should be asked to prepare for a possible emergency The theatre staff should be given the probable time of operation. In some cases for example when a strangulated hernia is admitted in the middle of the night and is thought to be fit for immediate operation, the surgeon will appreciate it if the patient is prepared for operation, the theatre is made ready and the surgeon is then informed that everything is ready for him to proceed

Surgeons also appreciate a telephone message which begins with the provisional diagnosis, such as Sir we have admitted a case of compound fracture of the femur rather than a long detailed account of the nature of the accident and general condition of the patient. These can be enlarged on after the provisional diagnosis has been given

Preparation for operation

In an emergency the normal procedure for preparation of a patient must be shortened

Open wounds should not be disturbed but the surrounding skin should be cleaned as long as this will not increase shock.

An acute abdominal case should have the skin of the abdomen shaved, cleaned with soap and water, and painted with an antiseptic such as 1 in 1 000 flavine in spirit. This procedure will not be carried out until the patient is fit to withstand it and it has been decided that an operation is necessary. If the patient is unfit, one must first restore fluid by an intravenous infusion, treat shock and if there is abdominal distension or vomiting, start gastric suction.

In all cases the urine should be examined for albumen and sugar before the patient goes to the theatre. This can be done in the ward and need not be postponed until the laboratory is opened.

Whenever a patient requires resuscitation before he becomes fit for operation, a chart must be prepared on which the important features are recorded every hour or half-hour. The information which is required will vary from case to case. Not all of the columns shown below are required every time.

Sample observation chart

Date 1 1 56

Time	*Pulse*	*B.P*	*Gastric Suction*	*Urine*	*Drip Fluid*	*Drugs*	*Remarks*
8.00 a.m.	120	70/30	400 c.c.		1st bottle Dextraven	Morph. gr $\frac{1}{4}$	
8.30	110	90/60	20 c.c.	cath. 4 oz.	and Dextrav		
9.00	110	105/70	20 c.c.			Atr gr 1/100	
9.30	100	102/70	25 c.c.				To Theatre

NON-URGENT CASES

The majority of surgical in patients are admitted either for treatment of some septic condition which does not require immediate operation or for preparation for operation on a particular day. The latter are sometimes known as list cases. Yet others are admitted with an uncertain diagnosis and will require investigation.

Admission

Admission to the ward is more deliberate than in the case of an emergency. The patient can be undressed and bathed and given

hospital clothes. He must not be permitted to retain any of his personal clothing in the ward, as this is a common source for the introduction of bed bugs

History and examination

After admission a careful history must be taken and a thorough examination made.

The examination must include all systems of the body but special attention must be paid to the haemoglobin level the condition of the heart and the presence of any pulmonary disease

Immediate treatment may be ordered for simple ulcers or other varieties of infection, and this may be commenced before the other systems are investigated

Apart from examination of the haemoglobin heart, and lungs special investigations will be required for particular cases Examples of these are X rays for bone and joint injuries and diseases or for renal or intestinal disease, and the estimation of the level of the blood urea in cases with chronic retention of urine.

Preparation for operation

Preparation for operation consists of two stages—preliminary and final.

Preliminary preparation In non urgent cases every effort must be made to make the patient as fit as possible before any operation is embarked upon

The haemoglobin must be raised to as near 100 per cent. as possible by giving iron by mouth or injection, or by blood transfusions the blood urea may have to be reduced by relieving obstruction by a suprapubic cystotomy (done under a local anaesthetic if necessary) tuberculous toxaemia may have to be reduced by rest and anti tuberculous drugs or amoebiasis may have to be treated. These are only examples but, as a rule, no patient should be given a general anaesthetic or be submitted to a major operation until he is as fit as possible to withstand the operation

Blood must also be collected from donors for transfusion during and after the operation if it is considered that this may be necessary

Final preparation The final preparation has a double purpose The first is to reduce to the absolute minimum the chance of wound infection at the time of operation the second is to prevent,

as far as possible, the complications of a general anaesthetic. The most important complication of anaesthesia is the possibility of vomiting while the patient is partially or wholly anaesthetized.

Preparation of the skin The most important antiseptic used in skin preparation is *soap* Proper cleansing of the skin will remove dirt and grease and also a very high proportion of the bacteria which contaminate the skin surface.

This must be impressed on the patient if he is fit enough to bath himself and he must be instructed to see that he gives himself a thorough wash, all over using plenty of soap and making himself as clean as he can He must be examined after this by the ward staff and either be bed bathed or sent back to bath himself again if necessary

A proper bed bath must be given to those who cannot wash themselves, and particular attention must be paid to the scrotum and perineum as there is an increased secretion of sweat there, and there is always faecal contamination possibly with tetanus spores

This thorough washing should not be left until just a short time before the patient goes to the theatre, but should be carried out daily from the time of the patient's admission Nothing else will have such a good effect in reducing the bacterial population on the skin.

After the patient has been thoroughly bathed attention can be turned to the actual area of operation. Even stricter attention must be made to skin cleanliness here. One must judge where the surgeon will make his incision and prepare the skin for a *wide* area round this. For example, operations on the upper abdomen will require a skin preparation that reaches up as far as the nipple line and down to the pubis an operation on the ankle will have to be prepared from above the knee to the tip of the toes, and an operation on the side of the face will require preparation of at least half the scalp

If the patient has been properly bathed, the first local preparation need not be done until the day before the operation, except in operations on bones or joints In bone or joint operations, the least little bit of operative infection may be so serious that final preparation of the skin must be commenced at least forty-eight hours before operation. The preparation, except for shaving is repeated twenty-four hours before the operation and again on the morning of operation.

The purpose of shaving is to remove all hairs which may retain bacteria Shaving, if it is done properly is bound to cause some damage to the skin surface, and these small injuries must be given twenty four hours in which to heal before the operation takes place

The desired area is shaved twenty four hours before operation and the skin is then painted with flavine or other antiseptic dis solved in *spirit* The spirit will still further remove grease, and both the spirit and the antiseptic will destroy more bacteria. The area is finally covered with a sterile towel in order to reduce the chance of fresh infection entering from outside.

On the morning of the operation the sterile towel is removed, the skin is again painted with antiseptic in spirit, and a fresh sterile towel is bandaged on

The patient should be provided with clean hospital clothes on the day before operation and these should be changed again on the day of the operation if they have been soiled.

The patient should not be taken to the theatre in the sheets or blankets from his bed, but in clean sheets and blankets sent on the trolley or stretcher from the theatre.

Preparation for the anaesthetic The stomach must be empty before a general anaesthetic is given. This is achieved by with holding all solid food for four hours before the operation, milk, which takes some time to digest, should be included amongst the solid' foods which are forbidden

This does not mean that the patient should be starved, in fact the reverse is the case. Many anaesthetics are liver poisons, and the liver will be much more vulnerable in the presence of hunger or malnutrition

Two hours before operation all patients must be given half a pint of tea, with plenty of sugar but no milk, or of sweetened orange or other fruit juice to raise the glycogen level in the liver This will not apply of course, to patients who are about to have an operation on the upper intestinal tract or who have intestinal obstruction and probably already have a gastric suction tube in place.

Special pre-anaesthetic drugs are referred to in the next chapter

Final general preparation Just before going to the theatre the patient should empty his bladder and, if this has not been done before, the urine must be tested for albumen and sugar The

surgeon or the anaesthetist *must* be informed if either abnormality is present.

It is normal, also to make sure that the lower bowel is empty, but the patient must not be weakened by vigorous purging

The lower bowel may be emptied by giving the patient half a fluid ounce of liquid paraffin and a moderate dose of cascara the night before the operation If his bowels open naturally by the next morning nothing further need be done, but if they fail to open a gentle enema should be given. The perineum must again be carefully cleaned with soap and water and if it is in the operation area, with acriflavine in spirit.

Additional preparation for special operations

Orthopaedic The need for a forty-eight hours preparation of the skin has already been stressed.

Thoracic operations and operations on the upper bowel If no special instructions have been laid down, the surgeon in charge of the case must be asked whether he wishes any special preparation to be made, such as the passage of a gastric tube for suction or the setting up of an intravenous infusion so that a transfusion can readily be substituted during the operation if necessary

Rectal operations In operations on the lower bowel every effort must be made to empty the bowel completely before operation but care must be exercised if obstruction of the lower bowel is present.

Cascara is given *two* evenings before the operation, and this is followed by a dose of salts on the following morning An enema is then given on the evening before operation and, on the actual day the lower bowel is washed out. Care must be taken not to run in too large a quantity of fluid at the time of the washout or it will run up into the colon and may be retained there, only to flow out again during the operation. A low washout must be given and the fluid must all be drained out again by siphoning it away through the washout tube.

Gynaecological operations These operations will require cleansing of the vagina as well as the surrounding skin, and one must find out before operation whether the operation will be done through the vagina or by incision of the abdomen.

The vagina may be cleaned by douching it with a ½ per cent.

solution of 'Dettol the evening before operation, and again on the morning of operation. Alternatively the vagina may be swabbed out with flavine in *water* (1/1,000) the evening before operation this is repeated on the morning of operation, and then a pack of flavine in water is lightly inserted into the vagina and left there.

The bladder must be emptied as in any other case, but if the operation is to be an abdominal one the bladder is emptied by a catheter and the catheter is *left in* It is strapped to the patient's thigh and a sterile spigot is inserted The bladder can then be drained into a receiver just before the operation starts and it can be allowed to go on draining into a pad of cotton wool all through the operation

It is not, of course, necessary to insert a catheter if the operation is to be done for a vesico-vaginal fistula and the patient has incontinence, but it is better to insert a catheter in all cases than to forget it when it is important.

A very thin narrow catheter should not be used as it may become kinked and cease to drain. A number 8 or 9 catheter will be found most suitable

CHAPTER 37

ANAESTHESIA AND ANALGESIA

An anaesthetic of one kind or another is used in almost every surgical operation The principal purpose of the anaesthetic is the relief of pain, but, when major operations are performed in the chest and abdominal cavities or on the limbs or elsewhere, the anaesthetic is also used in order to obtain some degree of relaxation of muscle. Muscle relaxation not only makes the operation easier for the surgeon, but it is also of benefit to the patient, because there will be much less pulling and bruising of tissues and the operation can be completed more quickly

Anaesthesia really means the abolition of all feeling and to achieve this the patient must be made unconscious Where only pain is relieved, but the patient remains conscious, it is more correct to talk of analgesia it is however quite common for the word anaesthesia to be used to describe all methods.

Some anaesthetics are safer to use than others but it must always be remembered that there are dangers attached to the use of every kind of anaesthetic, and that lack of skill in the giving of an anaesthetic may be even more dangerous than lack of skill in performing an operation.

SURFACE ANALGESIA

This may be achieved either by the application of solutions of cocaine, procaine or similar drugs to the surface of a mucous membrane, or by freezing the skin with an ethyl chloride spray

Freezing the skin is a painful process and the pain is even more severe as the skin thaws again. It is difficult to freeze more than a very small area, with the result that a surgeon is tempted to make a hurried stab into an abscess instead of opening it properly and releasing all pus and sloughs. It is very much better to give a short general or a regional anaesthetic. Freezing will not be mentioned again.

Cocaine and procaine have little effect on intact skin they are used principally to anaesthetize the urethra before the passage

of sounds and to anaesthetize the mouth throat or nose before examining or operating on the upper air and food passages.

The anaesthetic acts by paralysing the sensory nerve-endings after absorption through the surface. The drugs can also be absorbed into the general circulation, and an overdose must be carefully avoided

Five per cent. cocaine is a normal strength for ear, nose and throat work, solutions stronger than 10 per cent. should not be used. Cocaine is never used in the urethra owing to the danger of absorbing a toxic dose. Procaine may, however, be used in a 5 per cent. solution. This is a strong solution and not more than 30 c.c. should ever be injected into the urethra for surface analgesia. The addition of ½ c.c. of 1/10,000 adrenaline to each 30 c.c. of solution will reduce the chance of absorption into the circulation.

INFILTRATION ANALGESIA

This is an extremely useful method of obtaining analgesia. Procaine is most commonly used in strengths between ½ per cent. and 2 per cent. The more dilute the solution that is used the wider is the area that can be infiltrated.

Dangers

The principal danger is again that of absorption into the general circulation, this may cause convulsions and death. For this reason strengths greater than 2 per cent. should never be used for infiltration.

Not more than 30 c.c. of a 2 per cent solution should ever be injected but it is relatively safe to inject up to 200 c.c. of ½ per cent procaine. Further whenever the needle is inserted or pushed forwards one must always aspirate before injecting in order to make sure that the needle has not entered a blood vessel. Adrenaline may be added in order to reduce absorption into the general circulation but this should never be done if the injection is being given into a finger The adrenaline will cause a spasm of the digital arteries which may lead to gangrene of the finger

Infiltration should not be used close to a septic condition In the presence of an abscess with painful tension the injection of more fluid will be extremely painful the blood supply will

also be temporarily reduced and tissue planes opened up so that infection may spread. Regional or general anaesthesia should be used.

Uses

Infiltration can be very useful for the excision and suture of wounds if there is very little risk of sepsis for example in recent cuts of the scalp The needle can either be inserted through the skin all round the wound or it can be inserted into and under the skin through the edges of the wound itself

Infiltration will be even more effective if the main nerve to the affected part is anaesthetized. This is known as *regional analgesia* It is commonly used in dental surgery and it may be used in any other part of the body Two examples are the injection of the brachial plexus before operations on the upper limb, and injection of the digital nerves before they leave the palm of the hand, for operations on the fingers

SPINAL ANALGESIA

Spinal analgesia is one of the most useful methods of abolishing sensation and obtaining complete muscle relaxation below the level of the umbilicus

Dangers

A spinal anaesthetic can be made to act very much higher up the body than the level of the umbilicus, but the higher the level of analgesia the greater is the danger and, unless a specialist anaesthetist is available, it is wise to make sure that analgesia does not rise above this level.

If the analgesia is allowed to reach up into the upper abdominal and lower thoracic region the sympathetic nervous system will be paralysed and there may be a dangerous fall in the blood-pressure. If the anaesthetic goes higher still, there will be the added danger of paralysis of breathing and other higher centres.

Even when analgesia has been kept below the umbilicus there is almost always some fall in blood pressure. This is useful in some operations, for example on the prostate, because it will reduce the amount of blood that is lost during the operation but a spinal anaesthetic should never be used if the blood-pressure has already been lowered by shock or from other causes.

If the blood pressure falls too much *during the operation* the patient will feel faint and often becomes nauseated and vomits The head end of the table should be lowered at once, in order to increase the blood-supply to the brain centres, and the patient is given oxygen to breathe, the blood pressure can be raised by the injection of either 1 c.c. of ephedrine intra muscularly or 30 milligrams of methedrine, one half intra venously and the other half intramuscularly If a patient fails to respond it is probable that he is suffering from shock owing to loss of blood and it may be necessary to set up a drip in order to give a plasma substitute or a blood transfusion

Spinal analgesia carries the risk of two other complications. The first is the risk of infection of the meninges (which is avoided by careful asepsis during the injection) the second is post operative headache which is reduced by raising the foot of the bed for twelve hours after the patient returns to the ward.

Technique

The injection is made into the spinal canal in the same manner as a lumbar puncture. The injection must be made at a lower level than the second lumbar vertebra in order to avoid damage to the spinal cord. It is usually made between the fourth and fifth or between the third and fourth lumbar spines. The patient may either lie on his side or sit up during the injection and an assistant must make sure that the spine is fully flexed and not bent towards either side.

When the needle has punctured the dura, cerebrospinal fluid will flow out stovaine or nupercaine is then injected, and the patient rapidly placed in the proper position. The maximum adult dose of stovaine is 2 c.c.

The position immediately after the injection is most important. Stovaine and heavy nupercaine are both heavier than cerebro-spinal fluid and, during the first five minutes after injection, the drug will flow to the lowest part of the spinal canal After about five minutes the drug has become fixed by the nervous tissue and will not be able to flow to other parts of the spinal canal

If the operation is to be on the perineum the patient may be left sitting up and only the sacral nerves will be paralysed The patient will still be able to flex his thighs but the perineum will be analgesic.

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When the operation is to be on the legs or lower abdomen the patient must be laid on his back and the legs flexed. Whenever anyone lies on his back with the legs *straight* the lumbar spine will be found to be flexed up from the bed The spinal analgesic has been inserted in the middle of the lumbar region and is, so to speak, at the top of a hill when the patient lies on his back. Some of it will flow down to the sacrum while some will flow up towards the thorax. The danger of a flow up to the thorax will be increased if the table is not quite level.

Flexion of the legs will make the lumbar spine flat and the drug will remain where it has been inserted. A pillow under the head and shoulders will still further reduce the danger of upward flow The anaesthetist must look very carefully at the patient and at the table in order to make sure that there is no danger of the drug flowing to a dangerously high level.

After five minutes the operation area may be tested for analgesia by catching the skin with a sterile towel clip The patient should not be allowed to see this being done or he may exaggerate his response. If analgesia is perfect the legs are lowered and the patient is prepared for operation.

Failed spinal

Despite the best of care a spinal analgesic sometimes fails to work. In these cases a further wait of five to ten minutes may provide adequate analgesia. Alternatively the surgeon may use a local infiltration of procaine or a general anaesthetic may be given.

GENERAL ANAESTHESIA

Complete unconsciousness and analgesia may be obtained either by the intravenous injection of barbiturate drugs or by the inhalation of the vapour of a variety of agents

Dangers

There are many dangers associated with general anaesthesia. The most important of these dangers is a lack of oxygen to the tissues which, if it is complete for even quite a short time or if it is partial for a longer time, may lead to death. Anoxia arises most commonly from respiratory obstruction due to tight

relatively easy to alter the depth of anaesthesia, and the anaesthetist must be careful to avoid making the patient too deep or allowing him to become too light. The proper depth must be reached and must then be maintained the colour of the blood must be watched and the respirations very carefully observed.

If the breathing becomes quieter and lighter, the patient has either moved back to the second stage or forwards to the fourth. If one is in doubt it is safer to reduce the anaesthetic and let the patient begin to struggle than to make him too deep

In the third stage the eyelash and eyelid reflexes have disappeared, movements of the eyeball have ceased, and the pupil no longer reacts to light.

Technique

No anaesthetic should be given until the anaesthetist is sure that the right patient has been brought from the ward and that he is fit enough to stand an anaesthetic.

There are four parts to the giving of an anaesthetic. They are pre medication induction maintenance and recovery Part of the recovery should take place in the operating theatre, but final recovery usually occurs in the ward and is described in Chapter 39

Pre medication As described in the last chapter the stomach must be empty before any general anaesthetic is given. Aspiration of vomit into the lungs will cause severe post-operative complications, if it does not cause death.

Pre-operative drugs are given for two reasons—to reduce bronchial and pulmonary secretion and to provide preliminary sedation. Atropine is given principally to reduce bronchial secretion the normal adult dose is 1/100th of a grain It may be given subcutaneously half an hour before the operation or it may be given intravenously five minutes beforehand. The atropine tablets should be dropped into the syringe and crushed there before they dissolve. They must *NOT* be boiled or their effect will be destroyed Atropine acts by paralysing the parasympathetic nerves and so it also increase the heart rate, stimulates respiration, reduces laryngeal spasm and dilates the pupil.

Morphine or omnopon are given in order to reduce anxiety and to make induction easier They also have another important use in that they reduce the amount of general anaesthetic required

All anaesthetics are dangerous and the less the amount of any one of them that has to be given the better

The normal adult dose of morphine is one-quarter grain and of omnopon one third grain. Like atropine, the drugs may be given subcutaneously some time before induction, or intravenously five minutes before induction. These drugs cause respiratory depression this occurs within two to three minutes if the drugs are given intravenously, but may take up to an hour to become maximal when given subcutaneously As this depression may be dangerous if it takes effect during the induction of anaesthesia, subcutaneous injection should be given one and a quarter to one and a half hours before operation

Induction Every effort must be made to make the induction of an anaesthetic as smooth as possible. The patient should be relaxed and assured that he need have no worry The induction is best carried out in a special anaesthetic room so that there can be complete peace and quiet as the patient goes under and there will be no sight of the frightening masked and gowned surgeon and his assistants, or the trolleys covered with surgical instruments

Before starting the anaesthetic, one must make sure that there are no tight clothes or ornaments which might restrict breathing and that false teeth have been removed, if any are present.

During induction, the anaesthetist must watch the breathing watch the airway and watch the colour of the circulation. The last instruction is difficult to carry out with African patients owing to the pigmentation of the skin, but there will be no serious cause for worry if the anaesthetist takes the greatest care in ensuring an adequate supply of air or oxygen and makes quite sure that the patient has no obstruction to breathing either from the tongue falling back, or from the collection of mucus, or from spasm of the larynx.

Further details of induction are described later for each drug that is commonly used.

Maintenance Once the third stage of anaesthesia has been reached, the anaesthetic must be maintained at the desired level until the operation is over During maintenance, the rate at which an anaesthetic drug is given will be less than that used for induction. If the drug is given at the same rate as before, the depth will almost certainly be increased.

Maintenance requires the constant attention of the anaesthetist.

The respirations and the colour of the blood must be observed all the time. If the blood becomes dark, the patient has not got a proper airway or is well into the fourth stage with a failing circulation this must be corrected at once If the respirations become shallow the patient is becoming either too light or too deep Administration of the anaesthetic must be stopped at once and the eye reflexes tested. Movements of the eye can be inspected by drawing up the upper lid and seeing whether there is any movement of the eyeball—if the lid is difficult to raise the patient is too light. The eyelash reflex can also be tested, but one must *NEVER* test the 'corneal reflex This is done by touching the cornea with a finger and it is bound to cause damage to the eye.

During the operation the surgeon may complain that relaxation is insufficient.

This is not an indication for the anaesthetist to endeavour to increase the depth of the anaesthetic immediately The first step must be to check the adequacy of the airway by checking the position of the head, the position of the tongue and the presence or absence of mucus in the throat this is because the muscle tightness may be due to the patient struggling for air

The depth of anaesthesia may be increased only when one is satisfied that the airway is perfect.

Recovery All anaesthetic drugs are poisons, and the smaller the amount of them that is given the better Post-operative recovery will also be smoother if the patient is very nearly awake by the time he returns to the ward. (No patient should ever be returned to the ward until his cough reflex has returned and he is able to swallow secretions.)

An extremely deep anaesthetic is not necessary for operations on the limbs and, as the operation draws to a close, the anaesthetic can be slowly reduced so that the patient is nearly awake when the last skin stitch is inserted or the plaster of Paris is completed During abdominal operations very full relaxation is usually required but, after the peritoneum has been closed, the patient can be allowed to come gradually out of the anaesthetic. These stages in the operation will be observed by the anaesthetist if he takes an intelligent interest

If the patient is still unconscious when he leaves the theatre the anaesthetist must take very great care that he has an adequate airway All mucus must be removed from the throat the patient

must be turned on to his side and supported in that position with pillows and an artificial airway must be left in his mouth until he attempts to spit it out himself

Anaesthetized patients withstand movement badly and all movement from the theatre table to the bed must be smooth and gentle. Rough movement may precipitate shock if there has been much loss of blood during the operation.

THE USE OF VARIOUS DRUGS FOR GENERAL ANAESTHESIA

Intravenous anaesthesia

The most frequently used intravenous drug is Pentothal Sodium. It is supplied in ampoules which contain either half a gram or a whole gram of the powder which must be dissolved in sterile water One gram of pentothal is a highly dangerous dose, and more than half a gram should never be made up It should be dissolved in 10 c.c. of sterile water to make a 7 per cent. solution. Very great care must be taken not to inject pentothal into an artery as it may cause gangrene of the limb

After the drug has been injected into a vein, it takes a little time to get round the circulation and have its effect on the brain, so the drug must be injected cautiously Two to three c.c. can be injected quite quickly into a healthy adult, and then there should be a short pause while the patient is watched carefully he should rapidly become unconscious and start to breathe regularly This safety pause will also allow an accidental intra-arterial injection to be noticed. If the patient complains of sudden severe pain in the arm, intra-arterial injection should be suspected no further pentothal may be given, but 10 c.c. of 2 per cent. procaine should be immediately drawn up into another syringe and injected by the same needle, which is not moved until this is done.

If however anaesthesia is progressing smoothly further injections can then be given cautiously at the rate of ½ c.c. at a time. By the time the whole 10 c.c. have been injected the surgeon may have completed his incision of an abscess or reduced a fracture if he has not, an inhalation anaesthetic will be required.

As soon as the patient becomes unconscious, the pillow must be removed from under his head and his head turned to one side to prevent the tongue and jaw falling backwards and obstructing

breathing Spasm of the larynx may develop on rare occasions and pentothal should never be given unless an airway an oxygen cylinder and a face-mask are available so that oxygen can be given to the patient under pressure. The airway must be big enough to reach past the back of the tongue.

If the patient is anaemic, or if he has been shocked, a very small dose of pentothal may be quite sufficient to induce anaesthesia, and it will then be dangerous to inject even 2–3 c.c. quickly It must also be remembered that the circulation is much slower in old people than in young ones and no more of the drug must be given until the previous portion has had time to get round to the brain and to take its effect there.

(The student may see larger doses injected quickly by a specialist anaesthetist, but this is only done when it is to be followed immediately by the *skilled* administration of gas and oxygen)

Inhalation anaesthesia

Ether Ether is quite the safest of all the anaesthetic drugs used for general anaesthesia. It is still however a dangerous drug and must be treated with respect.

Ether can be used as the sole anaesthetic agent for both induction and maintenance, or it may be used for maintenance only after another drug has been used for induction.

The chief difficulty which arises with the use of ether is that it is extremely irritant. Spasm of the larynx can easily be caused during induction or during the change-over from another drug to ether

Ether is also very irritating to the conjunctiva. The eyes must be carefully protected both before the anaesthetic is started and all through the anaesthesia.

Very little spasm of the larynx will occur if the dose is increased very gradually A wad of gamgee tissue (wool enclosed in gauze) is placed over the patient's face in order to protect his eyes and the aperture in the wad is adjusted so that the whole of the nose and mouth are exposed. The patient is then told that if he breathes quietly and gently he will soon fall asleep

The ether must then be given very very gradually The mask may be placed on the patient's face and a few drops allowed to fall on it. Then, as the patient becomes accustomed to the

smell, the dose is gradually increased. Alternatively some ether may be poured on to the mask and the mask held a little way from the patient's face. As the patient becomes used to the drug the mask is slowly lowered until it is resting firmly on the gamgee tissue.

Ether evaporates very quickly, and the mask must finally be placed firmly on the face so that the patient can only breathe through the mask and not round the sides.

As soon as the patient is asleep the pillow must be removed, the head extended on the neck and the chin lifted up

The dose of ether is slowly increased until it is being given in a small but steady stream. If the patient holds his breath or develops spasm, the administration is stopped at once and, if the mask is very wet with ether the whole mask is removed so that the patient may have a few breaths of air As soon as the spasm has disappeared the mask is replaced and slow induction started again.

It may appear to be strange, but the more careful and slow one is over the induction, the quicker will the patient reach the third stage. This is because one has been able to avoid laryngeal spasm altogether

During induction, the head must be kept extended on the neck and the chin lifted up Once the patient has relaxed sufficiently, the mouth is opened and an airway inserted the airway must be of the right size. When the desired level of anaesthesia has been reached, a steady drip or small stream of ether is continued in order to maintain the anaesthesia at the right level.

Chloroform Chloroform was one of the first anaesthetic drugs ever used, about a hundred years ago It is very much more toxic than ether and can cause permanent damage to the liver it can also cause sudden death during induction resulting from damage to the heart and it can cause a burn of the skin or of the conjunctiva.

Chloroform is sometimes used for induction followed by maintenance with ether and in some hospitals it is used for maintenance as well. If a medical assistant finds himself in a hospital where only chloroform is available, and he is asked to give an anaesthetic, he must beware.

Induction is very much easier than with ether, *in fact it is dangerously easy* The author has seen a fatal case in which induction was given by chloroform the drug was poured on to the

mask the child developed some spasm, more drug was poured on the mask, the child took one big breath—and died

Only drops of chloroform must be used, never a stream. The mask should be held a little way from the face by one finger placed between the mask and the gamgee, in order to allow the patient to breathe plenty of air together with the chloroform, and, as with all general anaesthetics the airway must be kept clear

Once anaesthesia has been achieved, a very small quantity of chloroform is required for maintenance. Too much soon causes dangerous depression.

Ethyl chloride Ethyl chloride is closely related to chloroform and is equally dangerous. It may be only used for induction and never for maintenance. Its greatest advantage, and its greatest danger, is that the third stage can be reached in a matter of seconds—and the fourth stage a few seconds later

Induction is carried out in the same manner as that described for ether The patient is introduced to the drug very carefully in order to avoid mental apprehension or laryngeal irritation As soon as the patient becomes unconscious the dose may be increased

Ethyl chloride evaporates so quickly that a second wad of gamgee, or a towel or the anaesthetist's hand may be placed over the mask during induction to try to reduce evaporation.

The patient will rapidly enter the third stage if laryngeal spasm has been avoided. Entry to the third stage is shown by rapid, regular breathing *NO MORE ETHYL CHLORIDE MAY THEN BE GIVEN* The anaesthetic is at once changed to ether which may be poured on to the mask fairly freely Too much ether will be dangerous, but too little will let the patient come out again into the second stage A patient recovers from an ethyl chloride anaesthetic as quickly as he goes under with it—as long as he has not been given a fatal dose.

Nitrous oxide Nitrous oxide is obtained in cylinders in the same manner as oxygen but the cylinders are coloured pale blue. An adequate supply of oxygen must always be given with the nitrous oxide and the gases may be led through a bottle of ether if a deeper anaesthetic is required.

The ether is placed in a bottle and the two gases then pass over the ether and absorb its vapour Only a fully qualified doctor should use a gas and oxygen machine unless special training has been given.

Endotracheal anaesthesia For operations on the face or chest, a special endotracheal tube may be passed through the larynx into the trachea after anaesthesia has been induced. This allows gases to be passed right down to the lungs. The anaesthetic machine is connected to the endotracheal tube by a long rubber connexion and the surgeon will then have greater freedom during the operation

OTHER DUTIES OF THE ANAESTHETIST

The anaesthetist is one of the members of a team. His duties do not consist solely of rendering a patient unconscious and keeping him so

Apart from the surgeon, he is usually the senior person in the theatre, and he is almost always the most senior member of the team who is not scrubbed up

He can judge the patient s general condition better than the surgeon can, and it is his responsibility to keep a very careful watch on the patient The pulse must be taken at regular intervals, the blood pressure should be recorded if there is any sign of shock, and the operation should be watched. If there is a severe loss of blood during the operation, even more attention must be paid to the patient s general condition.

If the condition begins to deteriorate the surgeon should be warned, and the anaesthetist should either set up a drip himself or arrange for it to be done by someone else.

All operations should be carried out as quickly and as smoothly as possible for the sake of the patient. The anaesthetist can be of very great assistance by attending to the lighting and the position of the patient, among other things (see Chapter 38)

He knows what operation is to be performed, and he should see that the patient is placed in the proper position on the table, that the table is in the right position, and that the light is directed on to the wound. The anaesthetist will not necessarily do all these things himself but he will assist greatly if he gives any necessary directions to the unscrubbed nurse or orderly

The patient s clothing must also be adjusted dressings must be removed and the patient s arms placed out of the way The arms are commonly placed by the patient s side, with the thumbs under the buttocks. The hand must be turned down flat and great care must be taken not to drag the arm down from the

shoulder because of the danger of damage to the brachial plexus.

The anaesthetist's duties are not finally completed until he has seen that the patient is fit to return to the ward, that there is no mucus in his pharynx, and that he is placed on the trolley in such a position that the airway will not be obstructed. All apparatus must then be cleaned and prepared for the next case.

CHAPTER 38

OPERATIVE SURGERY

MINOR OPERATIONS

THE majority of the operations described in this section can be performed without assistance, and many of them can be done in the ward The rules for asepsis given in the next section must, however be observed as far as possible.

Many of the operations can be performed under a local anaesthetic, but for others a short general anaesthetic will be required. As much care must be taken over a short general anaesthetic as would be taken for a prolonged anaesthetic, and under *NO* circumstances should one person give a general anaesthetic and also perform the operation. The airway must be watched carefully the head being extended on the neck and the chin lifted up once the patient is unconscious. There must always be available a metal or rubber airway forceps and swabs for removal of mucus from the pharynx and an oxygen cylinder and face-mask so that oxygen can be given under pressure if necessary These important points cannot be attended to by someone who is also trying to perform an operation aseptically

INTRAVENOUS INFUSIONS

Saline, glucose, plasma substitute or blood may be given into a vein. The infusion may be given through a needle if the patient is only likely to require the infusion for a short time, and is not going to be moved from his bed. On the other hand any infusion which may be required for many hours or which may have to be continued while the patient is transported, should be given through a cannula which has been inserted into a vein by operation. Operative insertion of a cannula is also necessary when the veins are collapsed by shock.

Infusion by needle

No anaesthetic is required. The following equipment will be required a sterile giving set, a hypodermic syringe, a bottle of

saline or whatever other solution is to be used, a drip stand, a tourniquet, some swabs and spirit.

The giving set consists of a rubber cork containing two glass tubes, a length of rubber tubing, a drip-chamber, a tubing clamp and a needle One glass tube is longer than the other and should reach to the bottom of the bottle of fluid so that, when the bottle is turned upside down, the air bubbles will enter above the level of the fluid The rubber tubing is attached to the shorter glass tube The needle should be of a large bore. A fine-bore needle is easier to insert into a vein but will not permit fluid to run in quickly when this is required.

Procedure (1) Remove the patient's jacket or trousers and apply the rubber tourniquet round the upper arm or leg (Use the patient's left arm if he is right handed) The pressure should be enough to stop the venous flow, but not enough to stop arterial blood from flowing into the limb As the blood flows in the veins will steadily distend.

(2) If the giving set *is in a sterile container* this should now be opened

(3) Scrub up carefully and dry your hands. If no sterile towel is available it is better to dry your hands on a clean non sterile towel than to allow drips of water to drop from the fore arms and hands on to the giving set or operation area.

(4) Remove the giving set from its sterile container and insert the cork into the bottle of fluid. Get an unscrubbed assistant to make sure that the cork is inserted firmly and to apply the metal clip on the base of the bottle if this has not already been done. The assistant then turns the bottle upside down and *slowly* raises it. The needle on the other end of the tube is mean while held high and as the bottle rises all air bubbles will be driven out of the rubber tubing The bottle is then hung from the drip stand and the clamp on the tubing is closed.

(5) Clean the skin, insert the needle into the vein with the syringe, release the tourniquet, remove the syringe from the needle, attach the tubing and then release the clamp *on the* tubing

The normal speed for an infusion is forty drops per minute through the standard drip-chamber This may have to be in creased or decreased as circumstances indicate.

(6) Fix the tubing to the limb with adhesive strapping making

sure that the tubing is not kinked and that the needle lies freely in the vein. The infusion will stop if the opening in the needle is pressed against the wall of the vein.

Infusion by 'cutting down'

This procedure should be learnt thoroughly as the rapid infusion of blood or a plasma substitute may be life saving

Procedure (1) Collect the necessary apparatus. This will be the same as described above, together with a cutting-down set and a bottle of 2 per cent. procaine.

The cutting-down set consists of a hypodermic syringe, hypodermic needle, scalpel fine dissecting forceps mosquito artery forceps an aneurysm needle, catgut fine scissors cotton, silk or silkworm gut, an intravenous cannula and a suture needle.

(2) Remove the patient's jacket or trousers scrub up and set up the giving set as before.

(3) Select an appropriate vein, clean the skin with spirit and inject 2–3 c.c. of 2 per cent. procaine into the skin and into the subcutaneous tissue round the vein.

(4) While the anaesthetic is taking effect, check the instruments you will require, open a tube of catgut and thread a length into the aneurysm needle. Also thread a length of silk or silkworm gut into the suture needle. The cannula must also be connected by the tubing and drip-chamber to the bottle, and all air expelled from the tubing before it is clamped

(5) Make an incision *across* the front of the chosen vein The vein is always much deeper than one would expect, and there is no danger of dividing it by making an incision right through the skin and into the subcutaneous tissue.

Next, using the mosquito forceps in the right hand and dissecting forceps in the left, open up the subcutaneous tissue in front of and on each side of the vein The mosquito forceps should be closed, pushed into the tissue and then forcibly opened. The deepest part of the subcutaneous tissue over the vein, will be found to be *quite tough*

(6) In the same manner open up the tissue under the vein and pass the catgut through with the aneurysm needle. Tie the catgut round the vein at the most distal part that is exposed.

(3) *Taking the blood* Apply the sphygmomanometer cuff and inflate it to 80 mm. Attach the large bore needle to the short piece of rubber tubing and insert it into the chosen vein (A little local analgesic and a very small skin incision may be used) Allow the blood to flow into the sterile jug containing citrate, and stir it either with the stirring rod or by gently shaking the jug in order to prevent coagulation. The blood may flow more quickly if the donor opens and shuts his hand. When one pint has been collected, release the tourniquet and remove the needle.

(4) *Giving the blood.* Make quite sure that donor and recipient are compatible

Connect the long piece of rubber tubing to the funnel, and insert a piece of gauze into the funnel to act as a filter, then pour in some blood and get rid of all air bubbles from the tubing Apply a clamp to the tubing

Insert the medium bore needle into a vein with a syringe, and then connect the tubing in place of the syringe

As the blood runs into the vein, keep adding blood from the jug into the funnel

If a patient has a rigor during a transfusion there may have been an error in the compatibility test or the tubing may not have been properly cleaned the transfusion must be stopped at once

MAINTENANCE OF AN INTRAVENOUS INFUSION OR BLOOD-TRANSFUSION

An infusion or a transfusion requires constant attention. The bottle containing the fluid must never be allowed to run empty as air may be sucked into the tubing and then into the body, with possibly fatal results When a bottle is nearly empty the tubing must be clamped and a new bottle set up in place of the old one

Sometimes the drip chamber becomes too full of fluid, so that the drips cannot be counted or it may become full of air with the risk that the air may be sucked down the tubing into the body

These accidents can easily be remedied with the help of an empty sterile syringe and a long fine bore hypodermic needle. If the drip-chamber contains too much fluid the syringe is filled with air the tubing just below the chamber is cleaned with spirit and the needle passed through the tubing up into the drip

chamber sufficient air is then injected into the chamber to make it easy to count the drips. If, on the other hand the chamber contains too much air the long needle attached to an *empty* syringe, is passed right into the chamber from below, in the same manner as before the plunger of the empty syringe is then withdrawn, sucking out the excess air from the chamber

Cessation of infusion This may be caused by

(1) Puncture of the vein by the needle so that the fluid no longer enters the vein but passes into the surrounding tissues.

(2) Kinking of the tubing

(3) Pressure of the orifice of the needle or cannula against the wall of the vein.

(4) Occlusion of the vein by spasm.

(5) Blockage of the vein, needle or cannula by thrombosis of blood.

The fact that the end of the needle has passed into the tissues is shown by local swelling of the limb around the site of infusion. If this occurs then the needle must be withdrawn and a fresh infusion set up using a different site.

If, however there is no local swelling the first step to take is to adjust the position of the tubing and the needle. If the flow still fails to start again, the tubing should be pinched close to its lower end and 2 c.c. of 2 per cent. procaine injected into the lower end. The pressure of the syringe will drive the procaine into the vein, if it is not blocked by clotted blood, and any spasm will be abolished.

When all these measures fail, the drip will have to be taken down and set up again, using a different vein.

CATHETERIZATION

No anaesthetic is required for passing a catheter but very careful asepsis is essential.

Procedure After scrubbing up very carefully and drying your hands with a sterile towel place another sterile towel between the patient's thighs. Wrap a sterile swab round the penis and clean the glans. This may be done with a 2½ per cent. solution of Dettol but asepsis will be more certain if flavine in spirit is used. This is usually tolerated by the skin of the glans in circumcised patients but may be painful in the uncircumcised.

Apply sterile jelly or liquid paraffin to the catheter, and up the urethra The risk of sepsis will be even further if the catheter is not touched by the fingers but only with steril forceps

When the bladder is reached, the urine is collected into sterile receiver or kidney dish.

INCISION OF ABSCESSES

Abscesses may be incised either under regional analgesia under a short general anaesthetic.

If the abscess is very small, a quick incision is all that is required The wound may then be dressed with dry gauze or 20 per cent. saline.

Larger abscesses require a larger incision. The operator should scrub up and put on a pair of sterile gloves so that, when the abscess has been opened, a finger can be inserted to open any branches of the abscess and to loosen and remove sloughs.

The abscess may be left wide open and packed with gauze soaked in 20 per cent. saline, or part of the wound may be closed and the remainder drained with a piece of corrugated rubber. One must be careful, however, to see that the drain does not fill the whole of the drainage space or it will act as a plug instead of a drain.

EXCISION OF WOUNDS

This heading is deliberate. Excision of wounds is much more important than suture of wounds. A wound should *NOT* be sutured unless it is of recent duration and excision has successfully removed all foreign matter and all bruised and damaged tissue.

Anaesthetic Any wound that is sufficiently small to be included among minor operations can usually be excised under local infiltration of 2 per cent. procaine.

Procedure (1) Clean the skin with flavine in spirit, being careful to keep the spirit out of the wound itself then inject procaine all round the wound, either through the surrounding skin, or through the walls of the wound itself or into the neighbourhood of the nerves which supply the part.

chamber sufficient air is then injected into the chamber to make it easy to count the drips If, on the other hand, the chamber contains too much air, the long needle attached to an *empty* syringe, is passed right into the chamber from below in the same manner as before the plunger of the empty syringe is then withdrawn, sucking out the excess air from the chamber

Cessation of infusion This may be caused by

(1) Puncture of the vein by the needle so that the fluid no longer enters the vein but passes into the surrounding tissues.

(2) Kinking of the tubing

(3) Pressure of the orifice of the needle or cannula against the wall of the vein.

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(5) Blockage of the vein, needle or cannula by thrombosis of blood.

The fact that the end of the needle has passed into the tissues is shown by local swelling of the limb around the site of infusion If this occurs then the needle must be withdrawn and a fresh infusion set up using a different site.

If however there is no local swelling the first step to take is to adjust the position of the tubing and the needle. If the flow still fails to start again, the tubing should be pinched close to its lower end and 2 c.c. of 2 per cent. procaine injected into the lower end. The pressure of the syringe will drive the procaine into the vein if it is not blocked by clotted blood, and any spasm will be abolished.

When all these measures fail the drip will have to be taken down and set up again using a different vein.

CATHETERIZATION

No anaesthetic is required for passing a catheter but very careful asepsis is essential

Procedure After scrubbing up very carefully and drying your hands with a sterile towel place another sterile towel between the patient's thighs Wrap a sterile swab round the penis and clean the glans This may be done with a $2\frac{1}{2}$ per cent. solution of Dettol, but asepsis will be more certain if flavine in spirit is used. This is usually tolerated by the skin of the glans in circumcised patients but may be painful in the uncircumcised.

was described in the last chapter an anaesthetist can be of very great assistance by supervising some of this work. The 'clean' nurse is also responsible for supervising the work of the un scrubbed juniors.

The anaesthetist See Chapter 37

The surgical assistant The principal responsibility of the assistant is to make the operation easier for the surgeon by swabbing retracting tissues gently so that he can see better and passing instruments as they are required.

If the assistant knows his surgeon s methods, he can tell what instrument will be required next, and he will either have the instrument ready or ask the clean nurse for it. When a team is working well, the surgeon should not have to take his eyes from the actual operation for one moment, and he should not have to ask for more than a very few instruments or ligatures.

The senior or 'clean , nurse This is the nurse who scrubs up and is in charge of the instrument trolleys He or she is usually the senior member of the theatre staff and is responsible for the duties of the juniors

Long before the operation starts, the theatre nurses should study the operating list and get out of the instrument cabinets the instruments that will be required for each operation. It is very difficult to learn a whole list of instruments from memory but it becomes much easier if the staff know the surgeon s routine and think of the order in which the instruments will be used—first swabs, sponge holding forceps and acriflavine in spirit to clean the skin then towels and towel-clips then scalpel and dissecting forceps, next artery forceps, tissue forceps and *retractors etc.*

Only such instruments as will be required should be sterilized and set out for each operation While an operation is being performed, the instruments for the next operation can be placed ready in the sterilizing room and then sterilized and laid out on trolleys by one of the junior staff

Junior or assistant nurses A very great deal of the smoothness and speed of an operating theatre depends upon the proper training of the junior staff

Before the surgeon begins to scrub up the instruments for the first case should have been sterilized and laid out, lotion bowls filled and mackintosh sheets lithotomy posts or sand bags laid ready if they are likely to be required

The procedure will be even quicker and smoother if the senior nurse scrubs up early and lays out the instruments by hand instead of with Cheatle's forceps This reduces the number of people moving about in the theatre and, when all instruments are ready the nurse can prepare any necessary ligatures and thread needles.

If all the above has been done and nothing forgotten, there will be no need for any of the junior nurses to leave the theatre again until after the patient is in position and the surgeon has put on his gown and gloves and actually begun the operation.

Where there are two junior nurses, each should be given a particular job One will assist the anaesthetist and will help to get the patient into position, adjusting the light and removing the dressings, etc. The other will be responsible for tying the gowns of the clean nurse, the surgeon and his assistants and will be responsible for carrying out any instructions of the clean nurse

When the surgeon and his assistants move to the operating table, both junior nurses must check the position of lotion bowls swab buckets, etc. and must adjust the height of the table as desired. One should stand by with a kidney dish or other sterile bowl to receive the sponge-holding forceps

Only when the operation has begun and is progressing smoothly should one of the nurses withdraw in order to clean the instruments and linen from any previous operation and to prepare the instruments and trolleys for the next operation.

If there is a second assistant nurse, he or she should *NOT* leave the theatre throughout the operation. She will be responsible for collecting and counting all used swabs and she must be ready at once to make any adjustments to the tables lotion stands, etc. as they are required.

If the scrubbed up nurse wants something from outside the theatre, the inside nurse should not go and get it herself but should ask the outside nurse to do so

When the operation is nearly over the outside nurse must be warned. She must check that the trolley or stretcher is ready for removal of the patient and then come into the theatre again to remove instruments, used bowls and used linen. She can also assist in bandaging and removing the patient.

The senior nurse should not take any part in this work unless there is only one junior nurse. If there is adequate staff, the

senior nurse should scrub up again at once in order to be ready to lay out the instruments for the next case, when they are brought in on the sterilizer tray

After removing the patient, the junior staff rapidly clean the theatre and then carry on as before—one to assist the anaesthetist and the other to tie the gown of the senior nurse, fetch fresh instruments and lotion bottles and tie the gowns of the surgeon and his assistants

ASEPSIS

It is unnecessary to emphasize that every effort must be made, from beginning to end, to prevent any infection from entering an operation wound Absolute sterility is probably impossible, but as long as bacterial infection is as low as can be achieved, the body should be able to deal with the few bacteria that enter

Infection may enter the wound from the air, the theatre linen, the instruments, or the hands of the surgeon or his assistants.

The air

Bacteria can enter the air from many sources The chance that infection will reach the wound will be increased if the air is stirred up by a draught blowing through open windows or by a fan

In many tropical countries it is impossible to work unless the air is cooled in some way but every care must be taken not to have more breeze blowing than is absolutely essential for comfort.

In an ideal theatre, sterile air is gently blown in near the ceiling and non-sterile air extracted near the floor The air can be heated or cooled as necessary It is *quite wrong to have the* system working from the floor to the ceiling as that will suck up dust from the floor

The number of bacteria in the air can be further reduced by carefully cleaning the theatre furniture, and this *must include the* operating theatre lamp and all light flexes. The author has seen an acute peritonitis caused by the falling of dust into an open abdomen from an uncleaned light flex.

Bacteria must also be prevented from being brought into the room by staff or patient. *NO ONE* should be permitted to enter an operating theatre at *any* time wearing their outdoor shoes and

clothes. They must always put on a clean gown a cap and a mask, and put clean cloth or canvas covers over their shoes The scrubbing up team should scrub up in a separate room and only enter the theatre when they are wearing a sterile cap, mask, gown and gloves and clean boots, or shoe-covers

One must not forget the bacteria that can enter with the patient. These cannot be entirely excluded, but they will be very much reduced if the patient has been properly bathed and the skin prepared. The skin is always cleaned again in the theatre with an antiseptic in spirit before the operation is begun. The towel used in the ward to cover the skin after preparation must be sterile the bandages used to fix the towel must be clean and ward blankets must *never* be allowed in the theatre.

Finally, when the sheets, towels, dressings, etc., are removed from the patient they must be removed gently and carried out of the theatre or *gently* folded over the patient so that bacteria will not be shaken out into the theatre air

Theatre linen and instruments

These are sterilized by various means and they are not safe unless there is not a single bacterium on them. It is for this reason that instruments should be sterilized just before each operation and not laid out in the theatre at the beginning of the morning to remain there all through the operating list.

Sterilization is carried out by autoclaving by boiling or by chemicals. All linen and instruments must be absolutely clean before they are sterilized, and this is particularly important when chemical sterilization is used. A small clot of blood in the hinge or corner of an instrument may cover bacteria and protect them from the disinfectant. Bowls may also be sterilized by flaming a small quantity of methylated spirit is poured into the bowl and ignited.

Autoclaving sterilizes by steam. The steam is driven by pressure right into the centre of the drums and right through the linen inside them. The pressure also raises the temperature of the steam so that it is higher than that of boiling water It is most important, when using an autoclave, to make sure that the drums are not packed tightly with linen. If this is done the steam will not be able to penetrate as far as the centre.

Boiling is the most usual method used for the sterilization of

instruments Five minutes' boiling will destroy all the ordinary pathogenic bacteria, but twenty minutes' is required to destroy tetanus and other spores Five minutes' boiling means *five minutes at 212° Fahrenheit* it is of no use putting instruments into a sterilizer which is not yet boiling and then removing them five minutes later when the water has only been boiling for a minute or two Non sterile instruments or bowls must *not* be put into a sterilizer when other instruments are already there or if they are, another five minutes must elapse before any are removed.

It is commonly believed that sharp instruments are made blunt by boiling This is not so but they will be blunted if they are put in the sterilizer with other instruments, unless the sharp parts are properly protected by wrapping them in gauze

Chemical sterilization has two purposes One is actually to destroy bacteria and the other is to maintain the sterility of instruments, syringes etc. that have been sterilized by other means until they are required.

It is best to boil *all* instruments, but if chemical sterilization is preferred for sharp instruments, then pure lysol or 5 per cent. Dettol in spirit should be used these will sterilize *clean* instruments in two minutes

More dilute solutions of lysol will sterilize instruments if they are left in the solution for several hours and they may also be used for the storage of sterile instruments. Another useful chemical is formaldehyde. This is commonly used for the sterilization of catheters, especially ureteric catheters The formalin may be used in solution or it can be used as tablets from which formalin vapour will rise. Sterilization by formalin requires exposure for twenty four hours

Syringes, hypodermic needles, suture needles and sharp instruments can all be sterilized by boiling and then be kept sterile and free from rust by immersing them in the following solution

Borax	15 grams
Sol. of formaldehyde	25 c.c.
Phenol	2 grams
Water	to 1,000 c.c.

NAMES OF INSTRUMENTS

All members of the theatre team should know the names of the common instruments and their uses. These include the mouth-gags and airways used by the anaesthetist.

The surgical instruments are best remembered by the order in which they are commonly used. The names of some special instruments should also be learnt.

It is not possible to describe these instruments in words the student must see them, examine them and discuss their uses with members of the theatre staff The more important instruments are listed below

Common general instruments are

Sponge holding forceps
Towel-clips
Scalpels
Dissecting forceps toothed and plain
Scissors sharp-pointed or blunt pointed, curved or flat
Tissue forceps Littlewood s, Lane s and Allis s
Retractors sharp blunt, Langenbeck s self retaining—abdominal and vulval
Artery forceps curved or straight Spencer-Wells (5 in. and 7 in.) Kocher s mosquito
Gall bladder forceps
Needle-holders
Probes
Sinus forceps
Aneurysm needle
Volkmann s spoon
Trocar and cannula
Suture needles round bodied or triangular (cutting) straight, curved or half-circle small medium or large
Michel clips and introducers

Bone instruments

Hammers
Chisels
Osteotomes
Gouges
Amputation saws

Bone instruments—continued

Bone-cutting forceps
Steinmann pins and stirrups
Periosteal elevators

Other special instruments

Vulsellum forceps
Uterine dilators
Uterine curettes—flushing and plain
Adenoid curette
Scalp forceps
Trephine
Gigli saw
Tracheotomy tubes
Bougies or sounds
Proctoscope
Cystoscope
Sigmoidoscope
Intestinal clamps
Stomach clamps
Plaster shears
Plaster scissors
Plaster benders
Plaster opening forceps

TABLE POSITIONS

Most operations are carried out with the patient lying on his back. The hands are placed out of the way either on the patient's chest, under his head if he is conscious, or by his side. In the latter case the hands are opened out flat with the palms down and the fingers straightened the thumbs are then tucked under the buttocks It is emphasized again that great care must be taken not to drag the arm down from the shoulder as this may damage the brachial plexus if the patient is deeply anaesthetized

Lithotomy position

This is used for operations on the perineum, the anus or within the vagina. The patient's legs are raised upwards and outwards and fixed to special posts the foot end of the table is lowered and

the patient brought down the table until the perineum projects over the end. The table is moved towards the head end of the theatre so that the light can be shone on the operation area.

Modified lithotomy position

The full lithotomy position should not be used for cystoscopy as it tilts the pelvis too far and it is difficult to see into the bladder The legs should not be fully flexed and the perineum is not brought right down to the end of the table. Special posts may be used if they are available.

Trendelenburg position

This gives a good view into the pelvis from an abdominal incision. The foot of the table is lowered and the rest of the table is then tilted so that the head is down. The patient s knees should be placed opposite the break in the table and the legs tied to the lowered end Great care must be taken not to damage the popliteal vessels and nerves Special shoulder rests are provided on some tables to prevent the patient from sliding off but these are dangerous if the patient is fully relaxed, as they may damage the brachial plexus The surgeon s view is further helped by the fact that the intestines move with gravity towards the diaphragm. A pack is usually used to keep them there.

Kidney position

The patient is placed on his side. The lower leg is flexed up towards the abdomen, and the upper leg is stretched out straight. If a sandbag or special cushion is placed under the loin the kidney area will be well exposed.

The upper arm should be supported on a special rest

Thoracic operations

A position similar to the kidney position is usually adopted so that the chest may be opened from the side.

NAMES OF OPERATIONS

A great number of operations are given names by using the Latin name of the part of the body and then adding a suffix which has a particular operation meaning

The commonest suffixes are listed below together with examples of their use.

-otomy To cut into For example

Gastrotomy
Cystotomy
Cholecystotomy
Laparotomy
Arthrotomy
Osteotomy

-ostomy To make a temporary or permanent opening from a hollow organ to the surface or between two hollow organs (from the Latin *os* meaning mouth) In some cases the s is commonly, but incorrectly, omitted Examples

Gastrostomy
Colostomy
Tracheostomy (commonly known as tracheotomy)
Gastro-enterostomy
Cystostomy (commonly known as cystotomy)

ectomy To remove For example

Haemorrhoidectomy
Gastrectomy
Salpingo-oöphorectomy (removal of tube and ovary)
Hysterectomy
Cholecystectomy
Appendicectomy

CHAPTER 39

POST-OPERATIVE CARE AND WARD DRESSING ROUTINE

GENERAL POST-OPERATIVE CARE

THE principal objects of post-operative care are to relieve pain, prevent post-operative pulmonary complications, and prevent the formation of pressure sores, as well as treating the wound itself

Position of the patient

On return from the theatre, the patient may still be unconscious and may still have an airway in his mouth

If this is so he should be placed in bed on his side, with the head turned well over for drainage. The airway should be left in until the patient is sufficiently conscious to remove it himself or to attempt to spit it out.

Once the patient has recovered from the effects of a general anaesthetic, he should normally be given one or two pillows and be encouraged to turn freely into different positions. If he is un able to do so himself this should be done for him every two hours Frequent movement of the patient will not only reduce the chance of pressure sores developing but will also reduce the chance of pulmonary complications

The patient should not be given a back-rest or sat up in Fowler's position unless this is specially ordered. This position prevents free movement of the body and, as the patient slips down the bed, it very much reduces chest expansion. A pillow should never be placed under the knees because of the risk of thrombosis of the veins of the calf

The patient should be encouraged to get out of bed as soon as possible and sit in a chair for a short time then to start walking about the ward and to go to the toilet himself The patient may have to remain in bed for a long time after operations on the lower limbs or when he is seriously ill but the earlier he can be got up the better

if the bladder becomes distended and the patient is unable to pass urine, treatment will be required for relief of the distension.

Carbachol or prostigmine may be given by injection, and these frequently relax the sphincter The patient may also find it easier to pass urine if he is allowed to stand up or even visit the lavatory, as long as he is fit to do so

If the Carbachol fails to have the desired effect it can be repeated in half an hour and, if the patient has still not passed urine, this may be followed in another half-hour by catheterization with full aseptic precautions.

Repeated catheterization will be required whenever the bladder becomes full until the patient is able to pass urine by himself

The bowels

A slight degree of paralytic ileus always follows an operation inside the abdomen, and some degree of constipation is common after any operation.

As the ileus subsides, the patient may begin to feel some discomfort and colicky pain. This is due to irregular peristalsis and the pain will only be made worse if the patient is given purgatives at this stage.

The bowel should be kept at rest and the patient given a light diet for one or two days unless he has been ordered fluids only or nothing at all by mouth.

On the evening of the second post-operative day the normal patient is given a mixture of cascara and liquid paraffin and, on the following morning an enema is given if the bowels have not moved naturally Castor oil should not be prescribed it may cause severe colicky pain and once the bowels have been emptied, is frequently followed by a further period of constipation.

Thereafter the patient may take a full diet, and the bowels are kept regular by laxative drugs as required

Constipation is frequent in patients who are confined to bed. It is better to give a dose of cascara every evening if necessary, rather than to wait for two to three days and then purge the patient thoroughly

Haemorrhage from the wound

Post-operative haemorrhage is either delayed primary haemorrhage or secondary haemorrhage. The latter is due to gross

sepsis which has eroded through the wall of a large blood vessel. It used to be a common sequel to operations in the days before asepsis was introduced to operating theatres and in those days quite a large number of major operations were amputations which involved ligature of the major vessels of the limb At times hot tar was used to cauterize the wounds, instead of using ligatures. (Major operations on the abdomen and chest could not then be performed owing to the lack of anaesthetics)

The tourniquet which is so often tied to the end of the bed of an amputee is a relic of those bygone days it is no longer necessary as secondary haemorrhage has virtually been abolished.

Delayed primary, or reactionary haemorrhage is more common. The surgeon will always try to make sure that the wound is dry before he closes the skin, but bleeding may start again from small vessels, especially if the blood pressure was lowered during operation by the use of a spinal anaesthetic or from operative shock or if the tissues have been roughly handled.

If haemorrhage is severe the patient will have to be taken back to the theatre so that the wound can be reopened and the bleeding point caught.

More frequently however the bleeding is a capillary ooze that can only be controlled by pressure, as there are no major bleeding points to ligature. In order to do this properly the dressings must be taken *right off* and a fresh dressing wool and bandage applied. A blood-clot will be found under the dressing when it is removed, and blood will be found flowing out between the clot and the skin. Bleeding may still continue if this clot and dressing are left on, and fresh wool and a bandage are placed on top of the old dressings.

If the bleeding is from a limb the limb must be elevated.

SPECIAL POST OPERATIVE CARE

Operations on the bowel stomach and chest

A chart will be required, as described in Chapter 36, and all drip fluid and gastric aspirations must be recorded

A thoracic case may have had a drainage tube placed in the pleural cavity and this may have to be connected to a suction apparatus or drained into a bottle. The tube must be long enough to reach to the bottom of the bottle, and the end of the tube must lie under the surface of the antiseptic placed in the bottle.

Sterile gowns are not worn, nor do the members of the team have to scrub up and put on sterile gloves The hands are washed carefully until they are clean and they are then dried on a clean towel which does not need to be sterile. *It is most important to dry the hands so that drips of infected water will not run down to the ends of the fingers*

The dressing itself is done by a 'no-touch' technique in which sterile dressing forceps or dissecting forceps are used for cleaning the wounds and applying the sterile dressings. Only the handles of the instruments are touched by the nurses, and thereby infection is virtually prevented

Each surgical ward must have a sterilizer in which the bowls and instruments are sterilized before the dressings start the sterilizer is kept boiling until the dressings have all been completed and the instruments and bowls have been cleaned sterilized again and put away

The other principal requirements are drums to contain sterile towels and dressings a good supply of water, soap and towels and buckets to receive soiled dressings and bandages.

Technique

The minimum team consists of three nurses or dressers

One is the trolley nurse, in charge of the drums, dressings and lotions the second is in charge of the actual dressings while the third is the assistant nurse and general helper

The trolley nurse This nurse will wash and dry his or her hands before the dressings start, and need not do so again. He lays out on the trolley the necessary drums, lotion in bowls and two sterile kidney dishes. Two pairs of sterile forceps are placed in each kidney dish with the handles projecting over the side, and the drums are opened.

The dressing The helper undoes the bandages of the first case and discards them into one of two buckets. Very dirty ones will be destroyed relatively clean ones should be washed sterilized and used again

He then washes his hands, removes the outer dressings of the next case on the list, washes again and returns to assist the other members of the team.

The trolley nurse takes a swab of wool or gauze from the drum with his forceps and passes it to the second nurse. The latter

receives the swab with *his* forceps taken from the second kidney dish If he is careful not to touch the trolley nurse s forceps, then the trolley forceps can be used for the whole of the dressing round. If they contact the forceps which have touched the wound they must be discarded at once and not inserted into a sterile drum or a lotion bowl.

While the second nurse removes the old dressing and swabs the wound clean, the trolley nurse prepares the new dressing using his forceps the whole time. (If a dressing is very adherent it may be soaked off by pouring sterile saline on to it from a bottle. The bottle should have a rubber cork with a long bent glass tube and a short glass tube passing through the cork for ease in pouring The bottle is kept on the dressing trolley)

The second nurse takes the fresh dressing again being careful to see that his forceps do not touch the other s He applies the dressing receives and applies wool, places his forceps in their receiver and applies the bandage.

Meanwhile the helper has brought two clean sterile forceps in their own receiver from the sterilizer He now removes, cleans and sterilizes the used ones

The trolley nurse moves the trolley along to the case that has to be done next, while the second nurse washes his hands and the helper moves the buckets over

The procedure sounds complicated, but, with good team-work, each dressing should take less than five minutes No wound is exposed to the air for more than one or two minutes and no fresh infection should occur

Ward rounds

One last source of infection is exposure of wounds during the surgeon s rounds

Outer dressings may be removed before the round starts, but the dressings themselves should not be disturbed unless there is an excessive amount of pus. Leaving on the old dressing keeps the wound from exposure to the air and it also allows the surgeon to see how much discharge is present.

During the actual inspection by the surgeon, no talking should take place near the wound.

The dressing itself is removed with sterile forceps a new pair of forceps is used for each case. If the sterile forceps are all

placed in a kidney dish pointing the same way, they can be taken out by their handles without the other end of any of them being touched.

The dressing may be removed completely and discarded, and a fresh dressing applied This has the disadvantage that bacteria will be scattered in the air, and a second pair of clean forceps will be required to pick up the clean dressing from the tray which is being carried round. It is also uneconomical in the use of dressings

A better procedure is for the surgeon himself to take a pair of clean forceps and lift up the old dressing In many cases he will be able to see all he wants to without removing the dressing completely With the same forceps he replaces the dressing again at once and the wound has scarcely been exposed to the air If he requires a fresh dressing this can be passed to him by a nurse *using another pair of forceps, which are not allowed to* touch those in the surgeon's hand.

INDEX AND GLOSSARY

Technical terms not defined in the text are shown in *italic* type, together with the page reference to their first mention in the text. Page references in black type indicate the main reference to the topic.